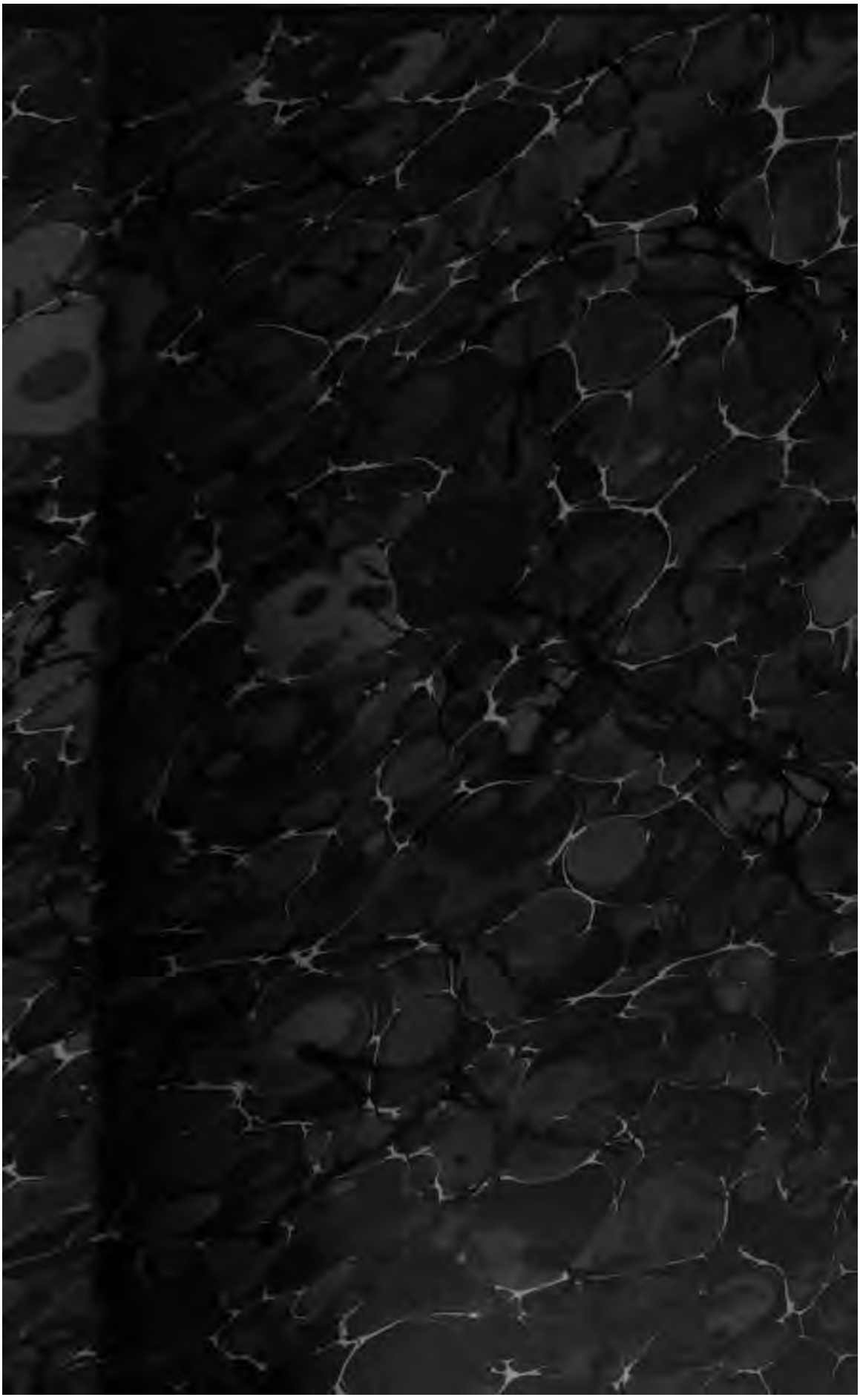

NOTES FOR A HISTORY

OF

STEAM NAVIGATION.

BY

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REAR-ADMIRAL U.S.N.

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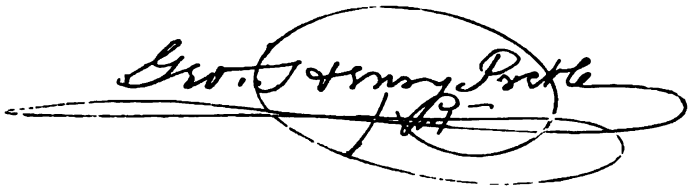

Rear Admiral U.S.N.

Twenty-five copies of these "Notes" were reprinted from the "United Service Review" for presentation to a few personal friends and the under-named societies which have honored me with membership at the dates named.

This reprint is now rendered of less value since the publishers of the magazine have published, under the title "A Chronological History of the Origin and Development of Steam Navigation, 1543–1882," an extended edition, which I have rearranged, revised, and corrected.

1. Bunker Hill Monument Association; member, 1842.
2. Naval Library and Institute; member, 1843.
3. Portland Society of Natural History; member, 1852.
4. New England Historic Genealogical Society; member, 1866.
5. Maine Historical Society; corresponding member, 1866.
6. Military Order Loyal Legion; companion, 1868.
7. State Historical Society of Wisconsin; corresponding member, 1869.
8. Pennsylvania Historical Society; member, 1870.
9. Numismatic and Antiquarian Society of Philadelphia; member, 1870.
10. Rhode Island Historical Society; corresponding member, 1872.
11. American Antiquarian Society; member, 1873.
12. New Hampshire Historical Society; honorary member, 1880.
13. New York Historical Society; corresponding member, 1881.
14. New York Genealogical and Biographical Society; corresponding member, 1882.
15. Prince Society of Boston; member, 1882.
16. Bostonian Society of Boston; member, 1882.
17. Massachusetts Historical Society; resident member, 1882.

Brookline, Mass., *November*, 1882.

KG 5[illegible]

NOTES FOR A HISTORY OF STEAM NAVIGATION.

1543.—June 17, Blasco de Garray, a native of Biscay, is asserted to have tried a steamboat of two hundred and nine tons, called the "Trinity," with tolerable success, at Barcelona, in Spain. The power consisted in a caldron of boiling water, and a movable wheel on each side of the ship.

The following is the story of De Garray in full:

In 1543 a mechanic of Marina, named Blasco de Garray, offered to exhibit in the presence of the Emperor Charles V. a machine by means of which a vessel might be impelled without the assistance of sails or oars. The proposition in the first place appeared ridiculous, but the engineer remained so convinced that the power of the machine would be adequate to the production of the effect announced, that he commenced anew his representations to the government, supplicating his majesty to command the execution of the project. The emperor, in consequence, appointed a commission to proceed to Barcelona to witness the experiment and to report upon the result. The engineer, Garray, secure now of making a proof of his invention, prepared a merchant ship called "La Trinidad," of two hundred tons burthen (thus states the record), and, the commissioners having arrived, the experiment was made on the 17th of June, 1543. Immediately upon a given signal, the vessel was put in motion; proceeding forward, it turned from one side to the other, according to the will of the steersman, and finally returned to the place whence it started without the assistance of sails, oars, or any visible machinery, except an immense caldron of boiling water, a complicated number of wheels within, and paddles gyrating without. The multitude assembled on the seashore remained filled with admiration at the sight of this prodigy, the port of Barcelona resounded with applause, and the commissioners, who witnessed the performance with the greatest enthusiasm, related to the emperor that Garray had accomplished with his machine as much as he had undertaken to do. But the head of the commission, Ravago, who was then chief treasurer of the kingdom, either through ignorance or some other of those unseen causes which influence the conduct of statesmen, showed himself but little favorable either to the inventor or the machine. After confessing the success of the experiment, and expressing his approbation of the ingenuity of Garray, he endeavored to persuade the

emperor that the invention would be of little or no utility; that its complicated construction would require constant repairs, attended with immense expense; that the vessel would not proceed at the rate of much more than a league an hour, and much more slowly when freighted; and, finally, that the boiler, unable to resist the force of the steam for any extended period, would frequently burst and become productive of the most dreadful accidents. Such was the substance of the opinion given by this covetous or invidious minister. Though Charles V. remained persuaded by the representations of his treasurer, he was not insensible to the merits of the inventor, whom he promoted to the rank of an officer, and in addition to the expenses of the experiment, presented him with a reward of two hundred thousand *maravedis* from the royal treasury, equivalent to sixty-six thousand *reales de vellon*, a very considerable sum at that period, and the munificence of which proves that the invention of Garray equaled, if it did not surpass, the most extraordinary productions of that era.

This statement was first published in 1826, by Thomas Gonzales, on the authority of documents said by him to have been discovered among the state papers at Simancas. Recent researches among those papers have failed to discover the documents in question, and the whole story is by universal consent considered a fable.

1630.—In Sanderson's edition of Rymer's "Fœdera," vol. xix., there is a copy of a patent granted by Charles I. to David Ramseye, a groom of the privy chamber, dated January 21, 1630. Among its specifications is one "To raise water from low pits by fire," and another, "to make boats, shippes, and barges to go against strong wind and tide."

1641.—A letter written by Marion Delorme, dated at Paris, February, 1641, suggested to Dumas one of the best scenes in one of his wonderful romances.

"PARIS, February, 1641.

"MY DEAR EFFIAT,—While you were forgetting me at Narbonne, and giving yourself up to the pleasures of the court and the delight of thwarting M. le Cardinal de Richelieu, I, according to your express desire, am doing the honors of Paris to your English lord, the Marquis of Worcester; and I carry him about, or rather, he carries me, from curiosity to curiosity, choosing always the most grave and serious, speaking very little, listening with great attention, and fixing on those whom he interrogates two large blue eyes, which seem to pierce to the very centre of their thoughts. He is remarkable for never being satisfied with any explanations which are given him; and never sees things in the light in which they are shown to him. You may judge of this by a visit we made together to Bicêtre, where he *imagined he had discovered a genius in a madman.*

"If this madman had not been actually raving, I verily believe

your marquis would actually have entreated his liberty, and have carried him off to London, in order to hear his extravagancies from morning to night at his ease.

"We were crossing the court of the mad-house, and I, more dead than alive with fright, kept close to my companion's side, when a frightful face appeared behind some immense bars, and a hoarse voice exclaimed, '*I am not mad! I am not mad! I have made a discovery which would enrich the country that adopted it!*' 'What has he discovered?' I asked the guide. 'Oh,' he answered, shrugging his shoulders, 'something trifling enough,—you would never guess it: IT IS THE USE OF THE STEAM OF BOILING WATER.' I began to laugh. 'This man,' continued the speaker, 'is named SALOMON DE CAUS; he came from Normandy four years ago, to present to the king a statement of the wonderful effects that might be produced from this invention. To listen to him you would imagine that with steam you COULD NAVIGATE SHIPS, move carriages,—in fact, there is no end to the miracles which, he insists upon it, could be performed. *The cardinal sent the madman away without listening to him.* SALOMON DE CAUS, far from being discouraged, followed the cardinal, wherever he went, with the most determined perseverance, who, tired of finding him forever in his path, and annoyed to death with his folly, ordered him to be shut up in the Bicêtre, where he has now been for three years and a half, and where, as you hear, he calls out to every visitor that *he is not mad, but that he has made a valuable discovery.* He has even written a book upon the subject, which I have here.'

"Lord Worcester, who had listened to this account with much interest, after reflecting a time, asked for the book, of which, after reading several pages, he said, 'This man is not mad. In my country, *instead of shutting him up,* he would have been rewarded. Take me to him, for I should like to ask him some questions.'

"He was, accordingly, conducted to his cell, but, after a time, he came back sad and thoughtful. 'He is indeed mad now,' said he; 'misfortune and captivity have alienated his reason, but it is you who have to answer for his madness. When you cast him in that cell you confined THE GREATEST GENIUS OF THE AGE!' After this we went away, and since that time he has done nothing but talk of SALOMON DE CAUS. Adieu! my dear and faithful Henry. Make haste and come back, and pray do not be so happy where you are as not to keep a little love for me.

"MARION DELORME."

1651.—An anonymous pamphlet was published in London, entitled "Inventions of Engines of Motion lately brought to Perfection," etc. The author claims "to have erected one little engine or great model at Lambeth," which among its capabilities was intended "*to*

draw or haul ships, boates, etc., up river against the stream." Steam is not indicated in the pamphlet, but it is difficult to conceive any other agent, unless some explosive compound by which the pressure of the atmosphere was exerted.

1663.—The Marquis of Worcester published a little book which he called "A Century of the Names and Scantlings of Inventions," in which he evidently describes an engine capable of raising water by the repellant power of steam. In this book one hundred inventions are enumerated, but the account of each is so short as often to be very obscure. Among his other boasts he says, "I can make a vessel, of as great a burthen as the river can bear, to go against the stream, which the more rapid it is the faster it shall advance, and the movable part that works it may be by one man still guided to take advantage of the stream, and yet steer the boat to any point; and this engine is applicable to any vessel or boat whatsoever, without, therefore, being made on purpose; and it worketh these effects,—it moveth, it draweth, it driveth (if need be) to pass London Bridge against the stream at low water; and a boat laying at anchor, the engine may be used for loading and unloading." A recent investigation of his patent shows, as it is expressly so stated, that he had no idea of using steam, but "the force of the wind or stream caused its motion."

1690.—Denis Papin, a French engineer, who was forced, after the revocation of the Edict of Nantes, to quit his country, took refuge at the court of the landgrave of Hesse, and was a professor of mathematics at the University of Marburg during several years. In 1690 he published a methodical and clear description of the fire-engine, now known as the atmospherical engine, and suggested the practicability of applying the power of steam to the navigation of rivers.

1695.—Papin, in another work dated 1695, says, "It would be too long to describe here in what manner this invention (the atmospherical engine) could be applied to drain rivers, throw bombs, and *row against wind*. I cannot abstain from remarking how much this power would be preferable to that of galley-slaves to navigate with rapidity to sea." Papin next criticises the use of men as agents, who, he says, occupy a larger space, and consume a great deal, even when they do no work, and observes that his tubes or pumps would be less cumbersome; "but," he adds, "as they cannot be conveniently adapted to ply common oars, it would be necessary to apply to them rotatory oars." He mentions having seen oars of that description fixed to an axle-tree in a boat belonging to Prince Robert of Hesse, which were turned by horses. He thought, however, that they might be put in motion by the *aid of a steam-engine*. To D. Papin is attributed the invention of the safety-valve.[1]

[1] The "Encyclopædia Britannica" appears to think that Papin's suggestions for the application of steam to navigation must be considered as theory alone, never

1698.—July 25, 1698, Captain Thomas Savary, an Englishman, took out a patent for raising water by the impellant force of fire. The same year he recommended the use of paddle-wheels similar to those now employed on steam-vessels, though without in the remotest degree alluding to his engine as a prime mover. It is probable he intended to employ the force of men or animals working a winch. In 1696 he obtained a patent for rowing ships with greater ease and expedition than had hitherto been done by any other. In 1698, "*He believed steam might be made useful to ships,*" but not daring to meddle with the matter, left it to the judgment of those who were better judges of maritime affairs.

1699.—M. Duguet appears to have tried revolving oars; and experiments were made with them on a large scale, both at Havre and Marseilles. This mode was soon given up as impracticable.

1736.—In the autobiography of the late John Barrow, undersecretary of the Admiralty, the following assertion occurs: "That neither Lord Stanhope, nor Fulton, nor the American Livingstone, nor Patrick Miller, nor his assistant, Symington, have the least claims of priority to the application of steam and wheels for propelling vessels. There can be no doubt that Jonathan Hulls was the real inventor of the steamboat."

According to the tradition current in the neighborhood in which he was born, Hulls was the son of a village mechanic at Hanging-Aston, near Campden, Gloucestershire; the name of the child being entered in a baptismal register December 17, 1699. Thomas Hull, or Hulls, the father, having removed from Aston to Campden, the boy was educated at the ancient grammar school there. With a natural turn for mechanics, Jonathan Hulls was brought up as a clock-maker, or rather clock-mender, —one of a humble class of artisans whose business it is to make a circuit through a certain district, cleaning and repairing cottage and farmhouse clocks, as well as the clocks of churches. He married early, and settled in the hamlet of Broad Campden about 1729.

During the earlier years of manhood Hulls bore the reputation of

carried out. But his correspondence with Leibnitz, which has recently been brought to light, fully proves *that he actually constructed a steamboat which he navigated upon the river Fulda;* which boat may serve as a warning to men not to be too clever for their age. M. Fournier relates that Papin labored at his construction for some years at Hanau, and that at Cassel, in presence of the landgrave, the boat was launched. The experiment succeeded, but he derived from it nothing but scorn, ridicule, or abuse. He was treated as a charlatan and a fool. Disgusted with the conduct of the Hessians, Papin attempted to go to London in his own vessel. He descended the Fulda as far as Münden, and was entering the Weser, formed by the union of the Fulda and Werra, when the boatmen of Münden, envious or suspicious of what might arise from the invention, laid violent hands upon him and his boat, —he escaped with difficulty, but his boat was destroyed. He tried in vain to obtain redress; and then came to reside in London, where he died three years afterwards, without having built a new boat.

being a thoughtful and studious man, and his neighbors regarded his superior mental powers with no small degree of respect. It is asserted that the idea which has given him some claim to posthumous honor occurred to him while he was yet young, and was matured in his own mind long before any channel was opened through which he could hope to make it known to the world; for Hulls had a family to support, and no means beyond a poor and precarious handicraft. A patron at last appeared in a Mr. Freeman of Batsford Park, whose seat (now that of Lord Redesdale) is situated about a mile from Aston, the native place of the inventor. By means of funds provided by this gentleman Hulls was enabled to go to London to procure a patent, and to publish a pamphlet in which his invention is described.

His patent is dated December 21, 1736, when Hulls was thirty-seven years old, and bears the sign-manual of Queen Caroline as a witness. In this instrument the invention is described as a "machine for carrying ships and vessels out of or into any harbour or river against wind and tide;" and it further sets forth that as the inventor could not at that time "safely discover the nature of his invention," he was afterwards to enroll a description of the same in the High Court of Chancery.

The little publication in which Hulls attempted to make his scheme known to the world was printed in London in 1737. It is entitled "A Description and Draught of a new-invented Machine for carrying Ves sels or Ships out of or into any Harbour, Port, or River against Wind and Tide or in a Calm." In his preface he says, "There is one great hardship lies too commonly upon those who propose to advance some new though useful scheme for the public benefit. The world abounding more in rash censure than in a candid and unprejudiced estimation of things, if a person does not answer their expectations in every point, instead of friendly treatment for his good intentions, he too often meets with ridicule and contempt. But I hope this will not be my case, but that they will form a judgment of my present undertaking only from trial. If it should be said that I have filled this tract with things that are foreign to the matter proposed, I answer: There is nothing in it but what is necessary to be understood by those who desire to know the nature of that *machine* which I now offer to the world, and I hope that, through the blessing of God, it may prove serviceable to my country."

This pamphlet appears to have attracted no attention, and Freeman, unwilling to risk further outlay, abandoned Hulls and his project. It is therefore evident that the invention did not receive a practical trial, and whatever hopes the projector might have based upon its success were disappointed. Commercially, like all the other ventures of Jonathan Hulls, it proved to be a complete failure. Incurring some derision from his want of success, he quitted the place where he was

best known and hid himself among the crowds of London, and, with what might be called a broken heart, died in extreme poverty, the date of his decease being unknown.

Jonathan Hulls was a man of no ordinary capacity, but we cannot concede that he "was the inventor of the steamboat." He, undoubtedly, in a rough way, was the first to point out how steam might be employed in the propulsion of vessels. His scheme was clever, but purely speculative. It did not receive any practical trial, and, like many other efforts of genius, came to nothing. John Scott Russell, however, in the "Encyclopædia Britannica," asserts that Hulls not only made a model of his invention, but that a boat was actually constructed and usefully employed.

1752.—Gautoir, a regular canon, and professor of mathematics, presented to the Royal Society of Nancy a memoir, in which, after having shown the inconveniences of navigation by means of sails, he employed a fire-engine (*machine feu*) of his own invention for navigating purposes.

1753.—Daniel Bournoulli wrote a memoir mathematically proving that a steam-engine might be used to advantage in vessels, which gained him a prize offered by the French Academy of Sciences.

His proposition was to propel vessels by wheels, with vanes set at "an angle of sixty degrees both with the arbor and keel of the vessel, to which the arbor is placed parallel. To sustain this arbor and the wheels two strong bars of iron, of between two and three inches thick, proceed from the sides of the vessel, at right angles to it, about two feet and a half below the surface of the water." The propellers for the stern he describes to be of similar construction, but shorter, and for driving them he says they "can be moved by men aboard the vessels, *or by steam engines*, or on rivers by horses placed in the barges."

Bournoville's plan is described, and several modifications proposed, in "Annales des Arts et Manufactures," tome 20, p. 329 (A.D. 1803). These represent, by drawings, shafts annexed at the sides, bow, and stern of the vessel. Each shaft carries eight wheels, each wheel having eight spokes with inclined, broad vanes at the ends. It is suggested that a shaft might go out at the stern, under water, through a stuffing-box, and means are described for raising the shaft which is under water. The steam-engine is proposed to be used to turn the shaft by having a T cross-head on the piston-rod, working vertically, with a crank or connecting-rod at each end, turning wheels, one of which works the shaft.

In 1753 Euler proposed to use a shaft with four floats at right angles. This was worked by a vertical shaft with a toothed wheel and pinion. Fincham's "History of Naval Architecture" has a drawing of this device.[3]

[3] Page 280. London ed. 1851.

In the same year "Mathon de la Cour proposed floats on each axle, and the intervention of an endless cord passing over a drum at the end of the axle, which was fastened to the side of the ship, and over a corresponding drum annexed to the frame."[3]

1756.—There was discovered in 1851, in the archives of Venice, a treatise on "Navigation by Fire," by M. Gautier, member of the Royal Society of Paris, which shows that the professor's plans for steam navigation were exhibited by him to the Venetian republic in 1756.

1759.—M. Genevois, a Swiss clergyman of the canton of Berne, published a book at Geneva containing what he called the discovery of the "*Great Principle.*" This was to concentrate power by whatever means obtained into a series of springs, which might be applied to a variety of purposes, among which he suggested the application of the "Great Principle" to propel a vessel by oars, and also proposed the application of an atmospheric steam-engine to bend or empower the springs by which the oars were to be worked; but his favorite project appears to have been to accomplish that object by the expansive force of gunpowder. M. Genevois visited England in 1760, and submitted his plan to the Board of Admiralty, but without receiving any encouragement. His apparatus resembled in principle the feet of aquatic birds, opening when moving through the water in one direction, and closing on its return.

1774.—The Comte de Auxiron made an experiment, but his boat moved so slowly and irregularly that those who had been at the expense of the trial at once abandoned all hopes of success.

1775.—The elder Perrier, for whom M. Arago claimed the honor of having constructed the first steamboat, and who was afterwards celebrated as the introducer of the manufacture of steam-engines into France, in 1775, constructed a vessel impelled by a steam-engine; but the power of the engine was so small—being scarcely that of one horse—that it could not impart sufficient velocity to the vessel to ascend the river Seine to any advantage. Not discouraged, and ascribing his failure to the use of paddle-wheels, he applied himself for some years to the search for other substitutes for oars. It does not appear, however, that he made any valuable discovery.

M. Ducrest published a work in 1777, which contains an account of various experiments made by Perrier in his presence.

In 1776 Guyon de la Plombiere suggested the use of the steam-engine for propelling a vessel.[4]

Mr. Andrew Ellicott, an American, in 1775, states that he had a conversation on the subject of steam with Mr. William Henry, of Lancaster, who suggested the possibility of applying steam to vessels,

[3] Fincham's History of Naval Architecture. London, 1851, p. 280, for drawing.

[4] Encyclopédie Moderne. Paris, 1855. Article "Vapeur," 171.

as did also Mr. Thomas Paine, the author of "Common Sense," in 1778.

1778.—The Marquis de Jouffroy made his first experiments, in 1778, at Baumes les Dames, and in 1781 he built upon the Saône a steam-vessel one hundred and forty feet long by twenty feet wide. In 1783, his experiments became the subject of a favorable report made to the French Academy of Sciences by Borda and Perrier. M. de Jouffroy demanded a patent, but before it was granted the Revolution compelled him to emigrate. On his return to France, in 1796, he learned that M. de Blanc, an artist of Trévoux, had obtained a patent for the construction of a steamboat.

March 10, 1779, Matthew Washbrough took out a patent for machinery to be attached to a steam engine, one use of which he mentions as follows: "Lastly, I intend to apply my engine, as described above, for the purpose of moving ships, boats, and lighters, or any vessel in water."

1782.—The Abbé Darical proposed several plans, which were in no way superior to Perrier's, and were speedily laid aside. In 1782, Desblancs sent a model to the Conservatoire des Arts et Métiers of a steamboat moved by a chain of floats carried by wheels at its side turned by a horizontal cylinder.

1783.—In the Great Patent Office Library, England, there is a copy of a French print by Jamont, dated A.D. 1816, entitled "Plan et profil du Bateau à Vapeur exécuté par M. L. Marquis de Jouffroy à Lyon, en 1783." It represents a steamboat one hundred and forty feet long, with paddle-wheels on a shaft turned by a single horizontal steam cylinder and a piston, with double rack work and pauls on the piston-rod.

1784.—Moses Hunter, under date May 19, 1788, certifies that in November, 1784, being at Richmond, Virginia, attending the Assembly as a representative from the county of Berkeley, Mr. James Rumsey informed him in confidence that "he intended to construct a boat which was to be wrought altogether by steam; that he had tried the principles, some of which he mentioned." From the whole tenor of the conversation, he understood Rumsey that his principal dependence for the operation of his boat was upon steam. A rude model seems to have been first exhibited to a select company of visitors to Berkeley Springs in the year 1784. No less a person than George Washington was of the favored few who witnessed the successful launch of the little boat, and testified to the value of the discovery. Fearful of his invention being stolen, Rumsey appears to have sworn all who witnessed the experiment to secrecy, for the certificate given him by General Washington, and meant for publication, is so carefully worded as to avoid using the word steam. It reads:

"I have seen the model of Mr. Rumsey's boat, constructed to work against the stream; examined the powers upon which it acts; been eye-witness to an actual

experiment in running waters of some rapidity; and give it as my opinion (although I had little faith before) that he has discovered the art of working boats by mechanism and small manual assistance against rapid currents; that the discovery is of vast importance, may be of the greatest usefulness, in our inland navigation; and if it succeeds, of which I have no doubt, the value of it is greatly enhanced by the simplicity of the work, which, when explained, may be executed by the most common mechanic.

"Given under my hand and seal, in the town of Bath, county of Berkeley, in the State of Virginia, this 7th of September, 1784.

"GEORGE WASHINGTON."

Later, Rumsey gave a public exhibition on the river, at Shepherdstown, Virginia, and afterwards, encouraged by his success, sailed for England, but thought it necessary first to destroy his precious model. He hoped in that older and richer country to perfect his work and realize fame and fortune. He was doomed to disappointment, and, after a long and harassing struggle, died before completing and satisfactorily demonstrating the principles of a new model.

A gentleman had, not many years ago, in his possession letters written by Rumsey in London, which mentioned receiving frequent visits there from a young American studying engineering, who showed a sympathetic and intelligent interest in Rumsey's labors. This was no other than Robert Fulton, who, nineteen years after Rumsey's death, gave the world a successful steamboat.

1785.—Thomas Jefferson, writing from Paris in 1785, describes a vessel then recently invented, which he examined while in operation. He says the inventor did not himself know the principle of his own invention. "It is a screw with a very broad or thin worm, or rather it is a thin plate, with its edge applied spirally round an axis. This being turned operates on the *air* as a screw does, and may be literally said to screw the vessel along. . . . The screw, I think, would be more effectual if placed below the surface of the water." Mr. Jefferson adds to his notes on this invention that he thinks Mr. Bushnell, of Connecticut, has a prior claim to the invention of the screw as a motive-power for vessels. During the Revolutionary war, he invented a submarine torpedo-vessel, to be driven by screws. This torpedo was the original of Fulton's, and may have been the first instrument of its kind; but the screw had been suggested as a motive-power for vessels long before the time of Bushnell. Brande's Dictionary says that "The screw-propeller is probably as old as the windmill, and a windmill of the construction now usually employed is represented in the seventy-seventh proposition of Hero's 'Spiritalia,' a work written one hundred and thirty years before the Christian era." For a century and a half efforts were made to introduce the screw as a propeller of vessels before Ericsson and Smith successfully demonstrated the utility of the screw, and its advantages over paddle-wheels.

The first attempt to connect a steam-engine with a screw-pro-

peller was made by Joseph Bramah, of Piccadilly, engine-maker, who, on the 9th of May, 1785, took out a patent for improvements in machinery, among which are described two new methods of propelling vessels through the water. The first of these contrivances was the application of a paddle-wheel to the stern of the vessel, which wheel was driven by a steam-engine, the rudder being placed in the *bow*, instead of the stern, in order to facilitate this contrivance.

His other invention was the application to the stern of the vessel of "a wheel with inclined fans or wings, similar to the fly of the smoke-jack or the vertical sails of a windmill." This wheel was to be fixed on the spindle of the rotatory engine without intermediate gearing, and wholly under water, where, by being turned either way, it would force the ship backward or forward, as the inclination of the fans or wings would act as oars with equal force both ways, and their power be in proportion to the size and velocity of the wheel, allowing the fans to have a proper inclination. Where the engine-shaft passed through the vessel it was to be made tight with a *stuffing-box*.

This is considered to be the *first* attempt at coupling together a submerged screw-propeller and the steam-engine for the propulsion of vessels, but there is no evidence that Bramah ever made or tried a propeller of the kind, and his rotary engine by which it was to be driven turned out a failure.

At a special meeting of the American Philosophical Society of Philadelphia, held on the 27th of September, 1785, John Fitch laid before it a drawing and description of a machine for working a boat against a stream by means of a steam-engine, and on the 2d of December following presented a copy of the model and drawing to the society, as appears by the minutes of Samuel Magan, one of the secretaries.

In the latter part of the year Fitch set out from Philadelphia with a view of visiting Kentucky, but turned aside from his purpose at Richmond, and petitioned the Legislature of Virginia for assistance for his steamboat. No formal report was made, but believing that the experiment would not be costly, he executed a bond to Patrick Henry, governor of Virginia, conditioned that if he should sell one thousand copies of his map of the Western country in that State at 6*s.* 8*d.* each, he would, in nine months thereafter, exhibit a steamboat in the waters of Virginia or forfeit the penalty of three hundred and fifty pounds.

In November of the same year he received from Patrick Henry, the governor of Virginia, the following certificate:[5]

"I certify that John Fitch has left in my hands a bond, payable to the governor for the time being, for £350, conditioned for exhibiting

[5] U. S. Patent Reports, 1849–50.

his *steamboat* when he receives subscriptions for one thousand of his maps, 6*s.* 8*d.* each.

(Signed) P. HENRY.

"November 16, 1785."

This provision was never put in operation, because the sales of the maps were very small. On his way back to Pennsylvania to print the maps, he stopped at Philadelphia, and presented a petition for assistance to the Legislature of Pennsylvania, and went immediately afterwards to Annapolis and made a similar application to the Legislature of Maryland. These attempts were not successful, and an effort to induce the State of New Jersey to appropriate one thousand pounds of loan certificates for the purpose of building a steamboat also failed. Shortly afterwards the Legislature of the latter State passed a law giving to John Fitch the exclusive right for fourteen years of making and using all and every species of boats or water-crafts which might be urged or propelled by the force of fire or steam in the waters of the State. He then returned to Philadelphia, and succeeded in forming a company. The stock was divided into forty shares. The original subscribers were Samuel Vaughn, Richard Wells, Benjamin W. Morris, John Morris, Joseph Budd, John and Chamless Hart, Thomas Say, Magnus Miller, Gideon Hill Wells, Thomas Palmer, Thomas Hutchins, Richard Wells, Jr., John Strother, Israel Israel, William Reubel, and Edward Brooks, Jr., each of whom had one share; Richard Stockton, of Princeton, three shares; Benjamin Say, two shares. Stacy Potts, of Trenton, was an early member of the company, but soon withdrew from it. In the beginning it was agreed that Fitch should have twenty shares for his interest and services in the experiment. The first difficulty of the company was about the making of a steam-engine. The assistance of Henry Voight, an ingenious clock- and watch-maker of Philadelphia, whom Fitch looked upon as a practical man of sound sense and experience, was obtained, and shares were gradually made over for his services, until in 1787 he held five.

The subscribers generally paid in twenty dollars each on their shares, and with this small sum the experiments were commenced. A model steam-engine, with a cylinder of one inch diameter, was made, but, although it worked, it was too small to demonstrate anything. A new model, with a three-inch cylinder, was then made and applied to a small skiff. With this machinery trials were made on the Delaware, about the 20th of July, 1786, with "a screw of paddles," a screw-propeller, the endless chain, and the side wheels, without much success. The next night, while in bed, Fitch thought of a plan of rowing the boat by oars or paddles on the sides, to be moved by cranks worked by machinery. He immediately rose and drew a plan, and the next morning showed it to Voight, who approved of it with some modifications. This was afterwards tried on the skiff with the steam-engine, and the first

boat successfully propelled by steam in America was moved in the Delaware on the *27th of July*, 1786, with flattering promises of the future usefulness of the invention.

The members of the company were so much pleased with its success that they determined to build a steamboat for practical use, as a passage and freight boat. But the original subscriptions were now exhausted, and the share-holders were tardy in the payment of new installments. Fitch induced a committee of the Assembly of Pennsylvania to report, in September, in favor of loaning him one hundred and fifty pounds; but the House rejected the report by a vote of twenty-eight yeas to thirty-two nays. Application was made to General Mifflin without success. Matters then languished for a while, during which a law was passed by the State of Delaware securing Fitch's right to the invention. A new deed was signed by the share-holders in February, 1787, and fresh advances were made. The engine was to be of twelve-inch cylinder, and the boat twelve feet beam and forty-five feet long. The engine was finished in May, 1787, but "the wooden caps" to the cylinder admitted air, and the piston was leaky. The works were all taken out to the foundation and set up again, when the condensation was found to be imperfect. New condensers and other machinery were made, and the boat moved at times as fast as three or four miles an hour. But something was continually going wrong. The work was very imperfect, the details of such machinery being unknown in America, and the workmen common blacksmiths. By entreaty the company was induced to persevere. On the 22d of August, 1787, this boat was propelled on the Delaware in the presence of nearly all the members of the convention to frame the Federal Constitution; but the rate of progress was too slow to satisfy the projector. Nevertheless, certificates of the perfect success of this attempt were given by Governor Randolph, of Virginia, Dr. Johnson of the same State, David Rittenhouse, the astronomer, Andrew Ellicott, professor in the Episcopal Academy, and Dr. John Ewing, of the University.

The following description of Fitch's steamboat was communicated to the *Columbian Magazine* by the inventor:

"PHILADELPHIA, December 8, 1786.

"TO THE EDITOR OF THE COLUMBIAN MAGAZINE.

"SIR,—The reason of my so long deferring to give you a description of the steamboat has been in some measure owing to the complication of the works, and an apprehension that a number of drafts would be necessary in order to show the powers of the machine as clearly as you would wish. But as I have not been able to hand you herewith such drafts, I can only give you the general principles. It is in several parts similar to the late improved steam-engines in Europe, though there are some alterations. Our cylinder is to be

horizontal, and the steam to work with equal force at each end. The mode by which we obtain what I take the liberty of terming a vacuum is, we believe, entirely new, as is also the method of letting the water into it, and throwing it off against the atmosphere without any friction. It is expected that the engine, which is a twelve-inch cylinder, will move with a clear force of eleven or twelve hundred weight after the frictions are deducted; this force is to act against a wheel of eighteen inches diameter. The piston is to move about three feet, and each vibration of the piston gives the axis about forty evolutions. Each evolution of the axis moves twelve oars or paddles, five and a half feet, which work perpendicularly, and are represented by the stroke of the paddle of a canoe. As six of the paddles are raised from the water six more are entered, and the two sets of paddles make their strokes about eleven feet in each evolution. The cranks of the axis act upon the paddles about one-third of their length from the lever end, on which part of the oar the whole force of the axis is applied. Our engine is placed in the boat about one-third from the stern, and both the action and reaction turn the wheel the same way.

"With the most perfect respect, sir, I beg leave to subscribe myself,

"Your very humble servant,

"JOHN FITCH."

1787.—Mr. Patrick Millar published in English and French an account of his naval experiments, illustrated with plates, copies of which were presented to every sovereign in Europe, to the American States, and to the Royal Societies in London and Edinburgh. In this work, speaking of the use of wheels as the moving power of vessels, he says, "I have reason to believe *that the power of the steam-engine may be applied to work the wheels so as to give them a quicker motion*, and consequently to increase that of the ship. In the course of the summer I intend to make the experiment," etc.

The same year Millar took out a patent for propelling boats by means of paddle-wheels turned by men. His vessel had a double deck, was sixty feet long, and had two wheels turned by two men each.

During the summer Mr. James Taylor proposed to Millar the application of a steam-engine to the wheels of his boat in place of the men, who were soon fatigued by the labor necessary to force the boat to any speed through the water. Dr. Brewster, speaking of the invention, says, "That this gentleman was the inventor of the steamboat in the strictest sense of the word I will not venture to affirm, but I have no hesitation in stating it as my decided opinion that he is more entitled to this distinction than any other individual who has been named." Dr. Brewster was not aware of the successful experiment of Fitch a year earlier.

The next and third boat propelled by steam within the waters of the United States was built this year, by James Rumsey, of Virginia,

who had a long controversy with Fitch as to the priority of the application of steam as a moving power for vessels. Rumsey tried his boat at Shepherdstown, Virginia, on the 3d of December, 1787, and the success of his experiment is certified to by Major-General Horatio Gates, Rev. Robert Stubbs, and others. This boat was propelled by sucking in water at the bow and ejecting it at the stern. It moved at the rate of four miles an hour, but made only one trip, and probably did not go half a mile in distance.

1788.—In 1788, Rumsey carried his invention to England and procured a patent for it. He then succeeded in inducing a wealthy American merchant to join him, and began building a steamboat. It was all but completed when Rumsey suddenly died. His partners got the vessel afloat in February, 1793, and sailed her many times on the Thames, against wind and tide, with a speed of four knots an hour.

The thought of drawing water in at the bow and pushing it out at the stern was not new, and is said to have originated with Dr. Franklin, or to have come originally from France. Mr. Arthur Donaldson proposed it, also, to the Assembly of Pennsylvania in 1786.

Rumsey this year published a pamphlet entitled "A Short Treatise on the Application of Steam; whereby is clearly shown from *actual experiments* that steam may be applied to propel boats or vessels of any burthen, against rapid currents, with velocity, etc. By James Rumsey, of Berkeley County, Virginia. Philadelphia, printed by Joseph James, Chestnut Street, 1788."

The fourth steamboat in the United States was built in 1788, by John Fitch, and proved eminently successful. This boat was sixty feet long, and had eight feet beam. The oars or paddles were placed at the *stern*, and pushed against the water. The engine had a twelve-inch cylinder. About the end of July, 1788, she was propelled by steam from Philadelphia to Burlington, some twenty miles, being the longest trip ever made by any boat under steam up to that time. On the 12th of October this boat took thirty passengers from Philadelphia to Burlington in three hours and ten minutes, a fact well authenticated by reliable certificates. Several other trips were made in 1788 and 1789.

About the middle of October, 1788, a boat, the joint production of Patrick Millar, James Taylor, and William Symington, propelled by steam, was put in motion on the Lake of Dalswinton, in Scotland. A successful and beautiful experiment. The vessel moved delightfully, and, notwithstanding the cylinders were only four inches in diameter, went at the rate of five miles an hour. The engine, in a strong oak frame, was placed in a pleasure-boat, the boiler being parallel to it on the opposite side of the vessel, and the paddles in the *centre* of the boat.

The vessel continued to ply for some days for the amusement of the projector, and to the astonishment of the country people, who assembled from all quarters to see a boat driven by *reik* (smoke). After

these experiments the engine was removed into the library of Dalswinton House, where it stood for a long time as an ornamental model. In 1870 it was on exhibition in London.

Satisfactory as was the result of this experiment, it did not fulfill all the designs of the inventors. A model vessel even as large as theirs might succeed and still leave it doubtful whether a larger scale might not impair the efficiency of the contrivance. Their success determined them to make an expensive trial on a large scale. From this determination resulted their second steamboat, constructed in 1789.

1789.—The date of commencing this vessel is fixed by the following letter, the original of which is preserved in the Millar family:

"DUMFERLINE, 6th of June, 1789.

"GENTLEMEN,—The bearer, Mr. William Symington, is employed by me to erect a steam-engine for a double vessel, which he proposes to have made at Carron. I have therefore to beg that you will order the engine to be made according to his directions. As it is of importance that the experiment should be made soon, I beg, also, that you will assist him, by your orders to the proper workmen, in having it done expeditiously. I am ever, with great regard, gentlemen, your most obedient humble servant,

"PATRICK MILLAR.

"TO THE CARRON COMPANY, Carron."

It was proposed to make the second experiment on the Forth or Clyde Canal. For this purpose Mr. Millar's large twin or double pleasure-boat, the same he had previously used with paddle-wheels, driven by men, was sent up from Leith to the Forth and Clyde Canal, at Grangemouth, on the Frith of Forth, to receive the new steam-engine.

This double or twin vessel was sixty feet in length, and had cylinders to her engines of eighteen inches diameter. Her engine was in all respects a larger machine than the first, but identical in construction, and of about twelve horse-power. At the first trial the boards of the paddle-wheels were broken by the concussion of the engine, which rendered the experiment incomplete, but on the 26th of December, 1789, the experiment was repeated, and the vessel propelled at the rate of *seven* knots an hour. The next day the voyage was repeated with the same success. The vessel being a light skiff with plank less than an inch thick, as soon as the experiments were over was replaced on her original station as a pleasure-boat, and the engine deposited at the Carron Works.

The following account of this experiment, drawn up by Lord Cullen, was published in three of the Edinburgh newspapers: "It is with great pleasure I inform you that the experiment which some time ago was made upon the Great Canal here by Mr. Millar, of Dalswinton, for ascertaining the power of the steam-engine when applied to sailing, has

lately been repeated with great success. Although these experiments have been conducted under a variety of disadvantages, as having been made with a vessel built for a different purpose, yet the velocity acquired was no less than six and a half to seven miles an hour.

"This sufficiently shows that with vessels properly constructed a velocity of eight or nine, or even ten, miles an hour may be easily accomplished, and the advantages of so great a velocity in rivers, straits, etc., and in cases of emergency, will be sufficiently evident, as there can be few winds, tides, or currents which can easily impede or resist it, and it will be evident that even with slower motion the utmost advantage must result to inland navigation."

1790.—In a petition "for an exclusive right to the use of steam navigation for a limited time," dated New York, June 22, 1790, addressed by John Fitch, of Philadelphia, to the Secretaries of War and State, and the Attorney-General of the United States, he states that "in the spring of 1785 he conceived the idea of applying steam to the purpose of propelling vessels through the water," and that "fully satisfied in his own mind of the practicability of such a scheme, he divested himself of every other occupation and undertook the arduous task;" that he had expended about eight thousand dollars in successive experiments, and that nearly four years of some of his grants of exclusive rights in several States, for the use of fire and steam in navigation, had expired before he was able to bring his engine to such a degree of perfection as to be carried into use. "That having at length fully succeeded in his scheme, proofs of which he is prepared to offer, he trusts he now comes forward not as an imaginary projector, but as a man who, contrary to the popular expectation, has clearly accomplished his design."

The fourth steamboat built in the United States not being considered fast enough, the steamboat company which had acquired an interest in John Fitch's invention built a fifth, which was first tried December, 1789, about the time Millar was making his second successful experiment in Scotland. Her speed not proving satisfactory, various alterations were made in her machinery, until April, 1790, when the most complete success was attained. In May, General Mifflin and the whole Supreme Executive Council of Pennsylvania were passengers in her. The following account of this experiment is given by William Thornton, Esq., who was one of the company interested, and a passenger on board:

"The day was appointed, and the experiment made in the following manner. A mile was measured in Front Street (or Water Street) Philadelphia, and the bounds projected at right angles as exact as could, to the wharves, where a flag was placed at each end, and also a stop-watch. The boat was ordered under way at dead-water, or when the tide was found to be without movement; as the boat passed one flag it was struck, and at the same instant the watches were set off; as the boat reached the other flag it was also struck, and the watches instantly

stopped. Every precaution was taken before witnesses, the time was shown to all, the experiment declared to be fairly made, and the boat was found to go at the rate of eight miles an hour, or one mile within the eighth of an hour. The Governor and Council of Pennsylvania were so highly gratified that, without their intentions being previously known, Governor Mifflin, attended by the Council in procession, presented to the Company, and placed in the boat, a superb silk flag, prepared expressly, which Mr. Fitch afterwards took to France and presented to the National Convention."

They were thus particular in ascertaining the exact speed of the boat, as on her going at the rate of *eight miles an hour* depended the assignment of her in shares to a company. It seems to be a little uncertain whether the silk flag presented contained the arms of Pennsylvania or was simply the flag of the United States.

The boat afterwards ran eighty miles in a day. She was placed upon the Delaware in the summer, and ran regularly as a packet, passenger, and freight boat for three or four months. Advertisements of her trips were published in the Philadelphia newspapers. Of these notices twenty-three have been found, giving advice of thirty-one trips to Trenton, Burlington, Chester, Wilmington, and Gray's Ferry. One of these advertisements, taken from *The Federal Gazette and Philadelphia Daily Advertiser* of Monday, July 26, 1790, is as follows. It will be seen it *was thought* sufficiently distinctive to call her *the* steamboat, since there was none other in the world at that time:

"THE

STEAMBOAT

Sets out to-morrow morning at ten o'clock, from Arch Street Ferry, in order to take passengers for Burlington, Bristol, Bordentown, and Trenton, and return next day.

"PHILADELPHIA, July 26th, 1790."

It is estimated that during the summer this steamboat passed over between two and three thousand miles. In the autumn she was laid up and never afterwards used, as there was not sufficient travel and transportation to pay the expense of running her.

Before this conclusion was arrived at the company had projected and commenced building another, intended for the navigation of the Mississippi, and called the "Perseverance." She was of twenty-five tons burden, and rigged schooner fashion. The boat was completed, and her engines nearly so, when she broke adrift in a storm from her fastenings at the wharf, and was blown on shore at Petty's Island, in the Delaware. Before she could be gotten off, the company in their attempts to simplify the machine had ruined it, and, moreover, had got into debt, which obliged them to sacrifice both boats and all the machinery.

1790.—William Longstreet, an American inventor, born in New Jersey, and who died in 1814, removed to Georgia. In 1790 he wrote

a letter to Thomas Tolfairs, of Savannah, asking him to assist him in raising the means to construct a boat to be propelled by steam. This letter was published in the Savannah and Augusta, Georgia, newspapers, but the funds were not immediately obtained. He was subsequently furnished with the necessary means for experiment, and constructed a small model boat upon a plan very different from Fulton's, which went on the Savannah River against the stream five miles an hour.[6]

May 7, 1790, Earl Stanhope patented a *Janus*-shaped vessel, which he styled an "Ambi-navigator," with a propeller in the form of a duck's foot, worked by a twelve-horse cross-head engine, with double connecting-rods, which at the conclusion of the experiment was laid up in Deptford Dock-Yard. This engine, at least such portion of it as could be made available, was subsequently (in 1802) applied to the *first steam-dredge*, built for the Admiralty. The "Ambi-navigator" had also a novel description of rudder, styled by the inventor an "equipollant rudder."

1791.—Mr. John Fitch, at the request of Aaron Vail, Esq., consul at L'Orient, was sent by the company to France for the purpose of building steamboats. A brevet of invention was granted to Fitch on the 29th of November, 1791, for his invention, but in the "Description des Machines et Procédes specific dans les Brevets d'Inventions expires Paris, 1811," it is stated that Des Blancs had previously proposed a similar scheme, and that a model of his plan had been deposited in the "Conservatoire des Arts et Méteirs."

Mr. Vail, unable to obtain workmen to build the boats, paid the expenses of Mr. Fitch, who returned to the United States. Mr. Vail afterwards subjected to the examination of Mr. Fulton, when in France, the papers and designs of the steamboat appertaining to the company.

Mr. Fitch as early as this year predicted that sailing-vessels would soon be superseded in transatlantic navigation.

1791.—Colonel John C. Stevens, of Hoboken, New Jersey, commenced his experiments in steam navigation in 1791, and by careful study succeeded in mastering the theory and practice of the steam-engine. With this knowledge as a basis, he made further investigations, which resulted in the inventions above alluded to, the first practical tests of which proved so satisfactory that he at once set about developing his ideas in order to devote them to the public good. His first attempts were made with a rotatory engine, for which he substituted one of Watt's. His first engineer proved an incorrigible sot. His second became consumptive, and died before his experiment was completed. He then resolved to depend upon his own resources, and built a workshop on his own estate, where he employed workmen under his own superintendence. It has been claimed that he invented the first tubular boiler about 1804, but Nathan Reed took out a patent for one in 1790. With various forms of vessels and different modifications of propelling appa-

[6] Appleton's American Cyclopedia.

ratus, he impelled boats at the rate of five or six miles per hour. They were in truth more perfect than any of his predecessors, but did not satisfy his own hopes and sanguine expectations.

1792.—Baron Seguier experimented with a submerged propeller.

1792.—The Historical Chronicle of the *Bee*, page 23, says, "Earl Stanhope's experiments for navigating vessels by the steam-engine, without masts or sails, have succeeded so much to his satisfaction on a small scale, that a vessel of two hundred tons burden on this principle is now building under his direction. The expense of this vessel is to be paid by the Navy Board in the first instance, on condition that if she do not answer after a fair trial, she shall be returned to Earl Stanhope, and all the expense made good by him."

A similar account of the earl's steam-vessel appeared in the *Gentlemen's Magazine* for October, 1792 (page 956), where it is stated that it was then being built under his direction by Mr. Stalkart, the author of a very valuable work on naval architecture. About this time Robert Fulton, then living at Torbay, in Devonshire, held some correspondence with Earl Stanhope on the subject of moving ships by a steam-engine.

1793.—The Earl of Stanhope, in 1793, revived the project of Genevois, and this machine, in 1795, was placed in a boat furnished with a powerful engine, and tried by him in Greenland Dock. In this experiment the paddles were two gigantic duck's feet, suspended from either side of the vessel, and opening and shutting like huge umbrellas. He was unable to obtain for his boat a greater velocity than three miles an hour. While engaged in this experiment he received a letter from Robert Fulton, who proposed the use of paddle-wheels; and it is probable his neglect to listen to this suggestion caused a delay in the introduction of the steamboat of at least twelve years, for it cannot be doubted that the ingenuity of Fulton, backed by the wealth and influence of Lord Stanhope, would have been as successful then as it was years later.

It is not known at what date Fulton's attention was first directed to the application of steam to navigation, but among the papers of Mr. Fulton, after his death, was found a letter from the Earl of Stanhope, dated at Holdsworthy, Devon, October 7, 1793, in which he says,—

"Sir,—I have received yours of the 30th of September, in which you propose to communicate to me the principles of an invention which you say you have discovered respecting the moving of ships by the means of steam. It is a subject on which I have made important discoveries. I shall be glad to receive the communication which you intend, as I have made the principles of mechanics my particular study," etc.

In 1792 or 1794, Elijah Ormsbee, a carpenter by trade, an inventor by birth, and a native of Connecticut, is said to have moved a boat successfully by steam. He had noted the difficulties of navigation on the Hudson River, and when afterwards he saw steam used as a power

for pumping water from mines, saw how those difficulties could be overcome. One day David Wilkinson, of Pawtucket, another inventor, stopped at Cranston, Rhode Island, where Ormsbee was at work, when Ormsbee said he had been thinking about a steamboat, and added if Mr. Wilkinson would make the castings he would make the boat; to which Mr. Wilkinson agreed, and went home and cast and bored a cylinder, and made the necessary wrought-iron connections. Two kinds of paddles were proposed; one called a flutter-wheel (a side-wheel) the other termed a goose-foot, which they decided to try, as the power could be applied more cheaply. Mr. Ormsbee obtained from Messrs. Clark & Nightengale the loan of a long-boat belonging to the ship "Abigail" for the experiment, and also borrowed from Captain Ephraim Bowen a copper still of about one hundred and fifty gallons capacity, and retreated to a place called Windsor Cave, where all of the wood- and much of the iron-work was done by himself. At last, one pleasant afternoon or evening in the autumn of 1792, he got into his boat, pulled the throttle-valve, and the boat glided out into the bay. He was yet fearful that his new-found power might fail him, and so sat silent and eager, watching the piston rise and fall and the paddles go to and fro. But it did not fail; the boat went steadily through the water, and arrived at Long Wharf in Providence. The next day Mr. Ormsbee left in the boat for Pawtucket to show Mr. Wilkinson the success which had attended his enterprise. After a day or two the boat came back to Providence, where it was received with astonishment. For several weeks the boat went up and down the river; Captain John H. Ormsbee, then a lad of twelve, going in her as steersman.

The steam was not applied to elevate and depress the piston as was done by Watt, but applied to raise the piston, and then being condensed by cold water, the piston was turned by atmospheric pressure. In this way the paddles of the boat were moved forward and aft. When they moved forward they closed, and when moved aft they expanded to a width of from eighteen to twenty inches. The progress of the boat was from three to four miles an hour, which would probably have been increased to five or six if wheels had been substituted for paddles. But Ormsbee had no Livingston with open purse to assist him, and so, after having demonstrated the possibility of steam navigation, his golden dreams faded, and he sorrowfully returned the still to the distillery and the boat to its owner.

When, in 1817, the "Firefly" arrived in Pawtucket, people remembered the steam long-boat, and said, "We have seen a boat go by steam before;" and Colonel John S. Eddy a few years since related that when fourteen years old he went with his father to Kettle Point and "saw Mr. Ormsbee in a canoe with a kettle in it raising steam to propel a boat." This was in 1794. He did not build it on Kettle Point, but went down there to get out of sight of people. He worked first on a

canoe dug out of a log, and afterwards applied steam to a long-boat. He used to talk a great deal when steamboats first came into use about Elijah Ormsbee's getting up such a thing a great while before. Mr. Henry H. Ormsbee, of Providence, has a statement in the handwriting of his father, Captain John H. Ormsbee, in accordance with this statement, and there is corroborative evidence on record in the files of the Transactions of the Society for the Encouragement of Domestic Industry. It was said by Mr. Wilkinson, who took the works after the boat was abandoned, that he exhibited and explained them to one Daniel French, who in turn made Robert Fulton acquainted with them.[7]

1794.—In 1794, Lord Stanhope addressed a letter to Wilberforce on the question of peace or war, likely, he thought, to be brought under discussion on the meeting of Parliament. In this he speculates on the possible resources of France, and hints that England is not invulnerable. His reasons are curious, and, considering the date, not without interest:

"This country, Great Britain, is vulnerable in so many ways, that the picture is horrid. By letter I will say nothing upon that subject. One instance I will, however, state, because it is information you cannot, as yet, receive from any other quarter; though in two or three months from the date of this letter the fact will be fully established, and you may then hear it from others. The thing I allude to is of peculiar importance. The fact is this. I know (and in a few weeks shall prove) that ships of any size, and for certain reasons the larger the better, may be navigated in any narrow or other sea without sails (though occasionally with), but so as to go without wind, and even directly against both wind and waves. The consequences I draw are as follows: First, that all the principal reasons against the French having the ports of Ostend, etc., cease, inasmuch as a French fleet, composed of ships of the above-mentioned description, would come out at all times from Cherbourg, Dunkirk, etc., as well as from Ostend, etc., and appear in the same seas. The water, even at Dunkirk, will be amply deep enough for the purpose of having them there. The French having Ostend, ought not therefore, under this new revolution in naval affairs—for it will be complete revolution—to be a bar to peace. Under the old nautical system, naval men might have reasoned differently upon that subject. But the most important consequence which I draw from this stupendous fact mentioned at the top of this page is this, namely, that *it will shortly render all the existing navies of the world* (*I mean military navies*) *no better than lumber*. For what can ships do that are dependent upon the wind and weather against fleets wholly independent of either? Therefore the boasted superiority of the English navy is no more! We must have a new one. The French and other nations will, for the same reason, have their new ones."

[7] History of Steam Navigation between Providence and New York, 1792–1877, by Charles H. Dow.

This is a curious prediction concerning the effect of the introduction of steam to navigation upon naval warfare and armaments, when we consider that the Earl's letter was written full thirteen years before Fulton's success with the "Clermont" on the Hudson.

July 15, 1794.—William Lyttleton took out a patent in England for a screw propeller, which was to be rotated by hand-power or a steam-engine.

The same year Samuel Morey, of Connecticut, who commenced his experiments on the Connecticut River in 1790, propelled his boat by a stern wheel from Hartford to New York City, at the rate of five miles an hour. Chancellor Livingston, Judge Livingston, Edward Livingston, John Stevens, and others were on board this boat when she went from New York to Greenwich. This was the *sixth* steamboat built in the United States.

The most reliable account of Morey's experiments and claim to having made the first application of steam to navigation, and the "first practical steamboat," was made and published, about 1864, by the Rev. Cyrus Mann, of Orford, New Hampshire. Mr. Mann, an educated man, of the strictest integrity, spent both time and research in investigation of the claims of Fulton, Morey, and others to the credit and honor of a practical success in steam navigation. The following is an extract from his book:

"The credit of the original invention of the steamboat is commonly awarded to Robert Fulton, but it is believed that it belongs primarily and chiefly to a far more obscure individual. So far as is known the first steamboat ever seen on the waters of America was invented by Captain Samuel Morey, of Orford, New Hampshire. The astonishing sight of this man ascending Connecticut River, between that place and Fairlee, in a little boat just large enough to contain himself and the rude machinery connected with the steam-boilers and a handful of wood for a fire, was witnessed by the writer in his boyhood, and by others who yet survive.[8] This was as early as 1793 or earlier, and before Fulton's name had been mentioned in connection with steam navigation."

The records of the Patent Office at Washington show that several patents for the *application of steam* were taken out by Morey previous to Fulton's for the application of steam "to boats." As Morey's great aim had always been to invent a steamboat, these patents doubtless had reference to that fact.

Captain Samuel Morey was a son of General Israel Morey, who moved to Orford from Connecticut in 1766. He died in 1843, aged seventy-one years. He originally owned fifteen hundred acres of woodland about Fairlee Pond, and employed a large number of men and oxen during the winter months in clearing the lumber for market, the

[8] Mrs. Nathaniel Mann was on board the steamboat of Morey, and "ordered it," as she said.

proceeds of which (forty thousand dollars) were consumed in scientific projects. He began as early as 1780 to give attention to subjects of light, heat, and steam, and invented several ingenious contrivances for various objects. He was a correspondent of Professor Silliman, of Yale College, and contributed to the pages of the *Journal of Science and Arts.* He also corresponded with Fulton, and visited the latter twice in New York, and exhibited the model of his boat, receiving one visit from Fulton in return.

It was after this visit to Morey that Fulton commenced his boat on the Hudson, and Captain Morey always held that Fulton surreptitiously imitated his model. In 1820, Morey put on Fairlee Pond a boat named the "Aunt Sally." It was twenty feet long, and neatly painted. Some unprincipled person or persons sunk it soon after its completion and trial trip, and it now rests beneath the waters of the pond.

Captain Morey continued his scientific pursuits up to the time of his decease, and these labors were more or less honored and recognized; still, he never recovered from the blow received through the alleged perfidy of Fulton.

In this year William Littleton patented a screw-propeller of three blades, and experimented with a copper screw so formed, as described by Colonel Beaufoy.

1796.—The tenth volume of the "Repository of Arts" contains a description of the fire-ship of Edward Thomason, which was laid before the lords of the Admiralty, in England, in 1796. It had wheels at the sides, operated on by steam-engines, and was intended to possess the power of moving given distances in all directions according to the intentions of the director, so that, without any person on board, it would conduct itself into an enemy's port, and by *clock-work,* at the given moment, explode the combustible.

The seventh successful steamboat was tried this year, in the United States, the invention of John Fitch after his return from France. The experiment was tried under the patronage of Robert H. Livingston, as certified to by John R. Hutchings, General Anthony Lamb, and William H. Westlock. The experiment was made with a screw-propeller, the vessel used was a yawl, the time was the summer of 1796, and the scene of the experiment was "*The Collect,*" a fresh-water pond in New York City, near what is now called Canal Street. The pond has been drained, and its site, covered with houses, is now in the heart of the city.

1797.—The eighth United States steamboat was built by Samuel Morey, assisted by the Rev. Burgess Allison, of Bordentown, New Jersey. It was constructed with paddle-wheels at the sides, in the same manner as Fulton's steamboat subsequently, and was propelled from Bordentown to Philadelphia in the summer of 1797, and publicly exhibited. In this year, also, Chancellor Livingston built a boat on the Hudson River, and obtained exclusive privilege from the New York

Legislature for one year, on condition that he produced a vessel impelled by steam *three miles an hour*, but which he was unable to effect. He was associated in this enterprise with a person of the name of Nisbett, a native of England. Brunell, afterwards distinguished as the engineer of the Thames Tunnel, acted as their engineer.

Morse, in his "Gazetteer," published in 1797, under the head of Territory, and referring to the Northwest Territory, says that he thinks "*it is probable steamboats will be found of infinite service in all our extensive river navigation.*"

1798.—The next vessel moved by steam, in the United States, was a model boat, about three feet long, built by John Fitch, at Bardstown, in Kentucky, in the summer of 1798, and tried upon the creek near that town.

1800.—This year Livingston and Stevens united their efforts, and were aided by Mr. Nicholas Roosevelt. Their apparatus was a system of paddles, resembling a horizontal chain-pump, and set in motion by an engine of Watt's construction. We now know that such a plan, if inferior to paddle-wheels, might answer the purpose; it, however, failed, in consequence of the weakness of the vessel, which, changing its figure, dislocated the parts of the engine. One of their workmen suggested the use of paddle-wheels, but Stevens candidly states their minds were not prepared to expect success from so simple a method. Their joint proceedings were interrupted by the appointment of Chancellor Livingston to represent the American government in France. Stevens, however, undiscouraged, continued his experiments at Hoboken, while Livingston carried to Europe the most sanguine expectations of success. Previous to these attempts, Mr. Nicholas R. Roosevelt and R. R. Livingston had made some experiments in steam navigation, the detailed account of which has not been preserved.

Messrs. Hunter and Dickinson are said to have taken out a patent in England in 1800 for propelling vessels by steam, which was tried on the Thames, in January, 1801. The English *Monthly Magazine* contains an account of this performance, "as very creditable to them, and as exceeding everything before accomplished"; and says that "the vessel was moved at the rate of three miles an hour through the water."

1800–1802.—Edward Shorter patented a screw-propeller in 1800, which was successfully tried by *manual* power, to move vessels of war, in 1802.

Mr. Samuel Brown had a boat built expressly for being propelled by a gas vacuum-engine (of which he was the inventor), made to drive a two-bladed submerged propeller, in the bow of the boat, by which a speed of from six to seven miles an hour was obtained.

Symington's Steam Tug, 1802.

1802.—In 1802, Mr. William Symington, who had been associated with Millar and Taylor in the experiments at Dalswinton, under the patronage of Lord Dundas, of Kerse, an extensive proprietor in the Forth and Clyde Canal, constructed a steam vessel for the purpose of superseding the use of horses in towing vessels along the canal. The following is his narrative of the experiment, the truthfulness of which has been confirmed by others:

"Having previously made various experiments, in March, 1802, at Lock 22, Lord Dundas, the great patron and steamboat promoter, along with Archibald Spiers, Esq., of Elderslee, and several gentlemen of their acquaintances being on board, the steamboat took in drag two loaded vessels, 'Active' and 'Euphemia,' of Grangemouth, Gow and Elspine, masters, each upwards of *seventy tons* burthen, and with great ease carried them through the long reach of the Forth and Clyde Canal to Port Dundas, a distance of nineteen and a half miles, in six hours, although the whole time it blew a very strong breeze right ahead of us; so much so that no other vessel could move to windward in the canal that day but those we had in tow."

When unimpeded by having other boats in tow, this vessel went steadily at the rate of six miles an hour, and may be considered to have been a complete success. Her cylinder had a diameter of twenty-two inches, and her piston a stroke of four feet. She had her paddle-wheel astern, and steering apparatus in front. Mr. Symington proposed to apply side-wheels to this boat, but it was feared they would injure the banks of the canal, and he was induced to substitute a stern-wheel.

The "Charlotte Dundas," as this vessel was called, is said to have cost three thousand pounds. If not the first practical English steamboat, she was certainly the first tug or tow-boat ever built, and her performance, says Scott Russell, writing in 1841, "appears to be about as great as any since accomplished by the many boats which on the same canal have attempted the same duty. So simple was the machinery that it might have been at work to this day with merely ordinary repairs."

1802–3.—In 1802–3, Robert Fulton, with whose name the history of steam navigation is inseparably connected, then spending the winter at Paris, made a small model, and wrote a description of a small steamboat with paddle-wheels.

About the same time, in connection with Chancellor Livingston, then the American minister at the French court, he commenced the construction of an experimental steamboat on a large scale, which was launched in the spring of 1803, on the Seine, below Paris, and the steam-engine and boilers put on board. He had, however, miscalculated the strength of his vessel, and when the weight of the ma-

chinery was placed in the centre she broke through the middle and sunk, and when raised was found to be unworthy of repairs. He therefore built a new hull to receive the machinery, which was but little injured, and in August, 1804, made a second trial. This new vessel was sixty-six feet long and eight feet wide; but she moved so slowly as to be altogether a failure. Soon after the experiment Fulton visited England, where, it has been asserted, he sought out Mr. Symington, and made a trip with him in his steam tug on the Forth and Clyde Canal. Mr. Symington himself said, "In compliance with Mr. Fulton's earnest request, I caused the engine fire to be lighted up, and in a short time thereafter put the steamboat in motion, and carried him from Lock 16, where the boat then lay, four miles west in the canal, and returned to the place of starting, in one hour and twenty minutes, to the great astonishment of Mr. Fulton and several gentlemen, who at our outset chanced to come on board."

An act was passed in the Legislature of New York, April 5, 1803, by which the rights and the exclusive privilege of navigating all the waters of that State, by vessels propelled by fire or steam, which were granted to Mr. Livingston in 1798, were extended to Mr. Livingston and Mr. Fulton for the term of twenty years from the date of the new act. By this law the time for producing proof of the practicability of propelling a boat by steam, of twenty tons capacity, at the rate of four miles an hour, with and against the ordinary current of the Hudson, was extended two years. Subsequently it was extended to April, 1807.

The story of Fulton's experiments on the Seine in 1803, and of his relations with Napoleon I., is thus graphically narrated by Mr. A. Ducasse:

"Between six and eight o'clock on the 8th of August, 1804, the two banks of the Seine at Paris, at the foot of the heights of the 'Pompe à Feu' at Chaillot, were crowds of curious observers collected together to witness an experiment the importance of which, unfortunately for the civilised world, was not recognized for a long time afterward.

"Fulton was trying on the Seine the first steamboat, already invented by him some years before, and subsequently offered in vain first to France, then to England, and subsequently to his native country, the United States, which adopted the grand discovery.

"On that evening, then, vast numbers of curious gazers were assembled on the quay, and unfortunately the Emperor, detained at the camp of Boulogne, was not in Paris. The trial took place without being witnessed by him, and, in spite of the scientific men delegated by his orders, this trial was not appreciated.

"A strange history is that of the short-lived relations of these two men of genius, Napoleon I. and Fulton, made to understand one another, and yet whom a fatal and jealous destiny seems to have perpetually kept apart.

"Towards the end of the year 1800, Fulton, then for some time residing in Paris, had been able to establish relations with several savans. He asked Volney, who was known to the First Consul, and who was a member of the Conservative Senate, to propose to the great man who governed France to make a trial of his system of navigation with steam as a motive power.

"Volney naturally addressed himself to Forfait, the Ministre de la Marine, who laid the matter before the First Consul in the following terms:

"'The Ministre de la Marine submits to the First Consul the proposals concerning the "Nautilus,"—the name of Fulton's steamboat,—which Mr. Robert Fulton, citizen of the United States, has placed before him, through the citizen Volney, member of the Conservative Senate.'

"On the 4th of December, 1800, the First Consul wrote on the margin of this demand the following decision:

"'The Ministre will treat this affair with Fulton, Volney, and others.'

"Napoleon, occupied with the affairs of Germany, whither Moreau was then marching to fight the battle of Hohenlinden, occupied with the vast interests placed in his powerful and organizing hands, unceasingly tormented with projects and inventions, did not at first seize the importance of Fulton's discovery. Moreover, he thought it was the business of the Ministre de la Marine to examine the affair, and to make a report upon it to him if it were serious.

"For the present, then, he thought no more about it.

"In the month of March of 1801, Forfait returned to the charge and submitted to the Chief of the State the following:

"'The Ministre de la Marine proposes to allow Fulton a sum of 10,000f. to enable him to make a thorough trial of the "Nautilus" at Brest, and to give him certain sums by way of reward.'

"Napoleon wrote on the margin of this demand, 'The First Consul agrees to this arrangement.'

"Fulton's project was then, by order of the Chief of the State, sent to the Institute to be examined. But it was not till three years later, till 1804, that the trial of the steamboat took place on the Seine, as we shall presently show.

"This boat, built under the direction of Fulton, by Messrs. Brown, of New York, was fifty metres long; it was moved by a double steam-engine, which turned paddles on each side, and gave it a speed equal to about that of a carriage drawn by post-horses.

"One fine day Napoleon bethought him of Fulton's project. It was at the time when he was in the midst of his troops at Boulogne, preparing his grand expedition against England.

"With his gaze constantly fixed on the great rival of France, he

sought every means likely to insure the success of his descent upon the bank of the Thames. The plan of the American engineer recurred to him. Great indeed would be the chances of success if Fulton had really discovered the means of moving ships by means of steam,—a power the use of which might be regulated and controlled in spite of tides and winds. What a wondrous and unequaled victory obtained over the elements!

"Napoleon then asked his Minister for Fulton's project. The Minister sent it, and on the 21st of July, 1804, the First Consul, two months ago hailed as Emperor, wrote the following curious letter:

"'I have just read the project of Citizen Fulton, Engineer, which you have sent me much too late, since it is one which may change the face of the world. Be that as it may, I desire that you "immediately" confide its examination to a commission of members chosen by you among the different classes of the Institute.

"'There it is that learned Europe would seek for judges to resolve the question under consideration. A great truth, a physical, palpable truth, is before my eyes. It will be for these gentlemen to try and see it and seize it. As soon as their report is made it will be sent to you, and you will forward it to me. Try and let the whole be terminated within eight days, as I am impatient.

"'FROM MY IMPERIAL CAMP AT BOULOGNE, this 21st July, 1804.'

"In the last two months the Parisians had seen with astonishment, off the quay of the Pompe a Feu, at Chaillot, a boat presenting a most strange appearance. It was armed, said the journals of the time, with two large wheels, placed on an axle like that of a cart. Behind these wheels, which were intended to be put in motion,—so ran the journals of 1804,—there was a sort of large stove with a pipe, a little fire-engine by means of which the wheels, and consequently the whole vessel, might be put in motion, turned, and made to go backward or forward.

"Some evil-minded persons had attempted, shortly after its arrival in the Seine, to sink it, and they had partially succeeded in their attempt. The relations of the period do not tell us who these persons were or what were their motives.

"When Fulton had repaired the injuries done the ship, the first trial of a steamboat in France, as has already been mentioned, took place on the Seine on the 8th of August, 1804. Fulton, assisted by three other men, put his boat in motion, taking in tow two vessels of less tonnage.

"During an hour and a half he afforded a curious crowd the strange spectacle of a ship moved, like a carriage, by wheels fitted with oars and set in motion by a fire-engine. The trial succeeded wonderfully, and appeared conclusive.

"The rate of progress up the Seine was from five to six kilometres per hour; in going down it was double.

"The ship was easily manœuvred in every direction, answered readily to the helm, was anchored without difficulty, and rapidly put again in motion. No well-broke horse was more easy to manage.

"At the present time all this excites no astonishment, but sixty years ago, when navigation was only comprehended by means of sails or oars, the wonder we have described was natural.

"What is really surprising is that the results of this trial were so unimportant; above all, when we remember that the Emperor had ordered a serious examination of the discovery by the members of the Institute, and that several of them, among whom were such men as Bossut, Carnot, Prony, Perrier, and Volney, were on board the 'Nautilus' when the trial trip was made.

"And yet, four days afterwards, on the 12th of August, the *Journal des Debats* received an article communicated by the Government on the subject of this trial, which terminates thus:

"'Doubtless they (the members of the Institute) will make a report which will give this discovery all the *éclat* it deserves, since this mechanism, applied to our rivers, would be fraught with the most advantageous results to our internal navigation,' etc.

"Thus it appears that the system was not considered applicable to maritime navigation, and thus Messieurs de l'Institut—ocular witnesses of a fact the consequences of which they were able to appreciate, and of which they had been ordered to find out the value and to explain the causes—thought it was consistent with their dignity to reject scornfully the most wonderful discovery that had ever been submitted to their lofty understanding.

"For the rest, this is no exception to the general rule. Have we not seen in our own time distinguished soldiers reject percussion powder for muskets? Do we not even now see breech-loaders rejected for the army? and has it not required the campaign of Sadowa to open the eyes of most of the chiefs of the armies of Europe?

"Be this as it may, the reports on Fulton's discovery were far from favorable. Scientific men rejected it. The Emperor is said to have sighed on reading their report, exclaiming, 'It is a pity!'

"What must have been the regret of the great captain when, eleven years later, while being borne into exile on board the 'Bellerophon,' under the English flag, he saw a small steamer manœuvring with facility in British waters, and, on inquiring who was the inventor, was told that his name was Fulton!"

1802–4.—In 1802, Oliver Evans agreed with James McKeever, of Kentucky (father of the late Commodore McKeever, U. S. Navy), and Louis Valcourt, to build a boat to run on the Mississippi between New Orleans and Natchez. The engine (Mr. Evans's high-pressure engine) was built in Philadelphia, and the boat in Kentucky; both were sent to New Orleans, but when the engine arrived out it was found

that the boat had been destroyed by a hurricane. The engine was then set to sawing timber in New Orleans, and Mr. Stackhouse (one of the engineers), who remained with it twelve months and fifteen days, states that during that period the mill was constantly at work, his words being:

"Nothing relating to the engine broke or got out of order so as to stop the mill one hour."

This was the kind of engine sent by Oliver Evans to drive a steamboat against the current of the Mississippi five years before Robert Fulton started the "Clermont" on the Hudson.

In 1804, Oliver Evans built a scow-steamboat at Philadelphia, for the purpose of clearing out the docks, which he called the "Eruktor Amphibolis."

In order to prove that wagons could be moved on land and vessels moved on water by the force of steam, Evans geared machinery to the wagon upon which the "Eruktor" was placed, and thus propelled his wagon by steam from the Centre Square, Philadelphia, to the Schuylkill River, at Market Street. The wagon-wheels were then taken off, the scow launched, and a paddle-wheel placed at its stern. It was then propelled down the Schuylkill to the Delaware, and up the latter river to Philadelphia, a distance of sixteen miles, passing several vessels bound to the same port.

The following is Mr. Evans's account of this experiment:

"In the year 1804 I constructed at my works, situated a mile and a half from the water, by order of the Board of Health of the City of Philadelphia, a machine for cleaning docks. It consisted of a large flat or lighter, with steam-engine of the power of five horses on board to work machinery to raise the mud into lighters. This was a fine opportunity to show the public that my engine could propel both land and water carriages, and I resolved to do it. When the work was finished I put wheels under it, and though it was equal in weight to two hundred barrels of flour, and the wheels were fixed on wooden axle-trees for this temporary purpose in a very rough manner, and attended with great friction of course, yet with this small engine I transported my great burthen to the Schuylkill with ease; and when it was launched into the water I fixed a paddle-wheel at the stern, and drove it down the Schuylkill to the Delaware, and up the Delaware to the city; *leaving all the vessels going up behind me* at least half way, the wind being ahead."

On the 26th of September, 1804, he closed an address to the Lancaster Turnpike Company as follows:

"It is too much for an individual to put in operation every improvement which he may invent. I have no doubt my engines will propel *boats against* the current of the Mississippi, and carriages on turnpike roads with great profit."

In 1805 he published a work describing the principle of his steam-

engine, with directions for working it when applied to propel boats against the current of the Mississippi, and carriages on turnpike roads.

1804.—In May, 1804, John Stevens[9] constructed a steamboat which went from Hoboken to New York and returned; its propelling power being a wheel at the stern, formed in the manner of a wind-mill or smoke-jack, and driven by a rotatory engine.

The engine not proving successful, it was superseded by one of Watts's engines, when the vessel attained an average speed of four miles an hour. For a short distance Stevens could make his boat go at a speed of seven or eight miles per hour; but was unable to maintain that speed for any length of time from a deficiency of steam.

Professor Renwick read a paper several years since before the New York Historical Society, in which he stated that the first he ever heard of an attempt to use steam for the propulsion of vessels was from a classmate who, in 1803, witnessed an experiment made upon the Passaic River by John Stevens, of Hoboken. According to his account, the propulsion was attempted by forcing water, by means of a pump, from an aperture in the stern of the vessel. In May, 1804, Mr. Renwick saw Robert L. Stevens and the late Commodore Stevens, as he was styled, cross from the Battery to Hoboken in a boat propelled by steam. This boat was a small one, and had tubular boilers, the first ever made. The machinery was made under his own directions, and in his own shop at Hoboken. It set in motion *two* propellers (the first double-screw) of five feet diameter each, and each furnished with four blades having the proper twist,—to obtain which he had the greatest difficulty with his workmen,—and set at an angle of thirty-five degrees. It is a proof of the remarkable accuracy and skill of the Hoboken workshop that the engine of this first small propeller, which is carefully preserved in the Stevens Institute of Technology at Hoboken, was set up again about forty years afterwards (1844) in a new vessel, which was modeled on the lines of the first boat, and without altering a screw was worked most successfully, and in the presence of a committee from the American Institute was propelled at the rate of eight miles an hour. The second vessel is also preserved in the Stevens Institute at Hoboken. Three years before Robert Fulton's steamer, the "Clermont," plowed its way up the Hudson, this engine and boiler, in the hands of Colonel John Stevens, had demonstrated the efficiency of the screw propeller.

[9] Colonel John Stevens, born in New York, 1749. Died at Hoboken, New Jersey, 1838. Colonel Stevens was the father of Edwin A. Stevens, founder of the Stevens Institute of Technology. During the war of the Revolution he served in a variety of civil and military capacities, and afterwards became the owner of large estates in New Jersey.

In 1787 he became interested in steamboats, from seeing that of John Fitch, and experimented for near thirty years. In 1789 he petitioned the New York Legislature for a grant of the exclusive navigation of the waters of that State, but without success.

1806.—Encouraged by the success of his former experiments, Colonel Stevens repeated them in 1806 on a larger scale, and built a pirogue fifty feet long, twelve feet wide, and seven feet deep, which attained considerable speed. He named her the "Phœnix."

The "Clermont."

1807.—In the spring of 1807, Robert Fulton launched from the building-yard of Charles Brown, on the East Hudson, a steam-vessel, one hundred and thirty feet long, and having eighteen feet beam and six feet hold, which he named the "Clermont," after the residence of his friend, patron, and associate, Chancellor Livingston. The "Clermont" was provided with a single engine, built by Boulton and Watt, in England, which lay for many months on the wharf at New York, near where the city prison now stands, between Canal Street and the Battery, being held by the agent of the ship which brought it over for non-payment of freight. This engine was twenty-four inches diameter of cylinder, and three feet stroke. The "Clermont's" boiler was of the low-pressure pattern, twenty feet long, seven feet deep, and eight feet broad. She had side-wheels fifteen feet diameter, with four feet buckets dipping two feet in the water. The "Clermont" started on her first trip from New York for Albany, at one P.M., on the 7th of August, 1807, just three years, to a day, after his experiments with the "Nautilus" on the Seine.

Robert Fulton, with a few friends and mechanics and six passengers, was on board. An incredulous and jeering crowd were gathered on the shore as she cast loose. She arrived at Clermont, a distance of one hundred and ten miles, on Tuesday at the same hour; leaving Clermont on Wednesday at nine A.M., she arrived at Albany at five P.M. the same day, a distance of forty miles in eight hours. "The run," says Fulton, "is one hundred and fifty miles in thirty-two hours,—nearly equal to five miles an hour. She kept up the same rate of speed on her return trip to New York, and made several trips during the summer with like results."[10]

Professor Renwick, describing the "Clermont" as she appeared on her first trip, says, "She was very unlike any of her successors, and very dissimilar from the shape in which she appeared a few months afterward. With a model resembling a Long Island skiff, she was decked for a short distance at stem and stern. The engine was open to view, and from the engine aft a house like that of a canal-boat was raised to cover the boiler and the apartment for the officers. There were no wheel guards. The

[10] Marcus Richardson, of Bangor, the oldest Mason in Maine, and probably in the United States, who died in that city January 7, 1881, aged one hundred and six years and two months, witnessed this trial trip of the "Clermont." He was a privateersman in the war of 1812, and was a Mason seventy-seven years.

rudder was of the shape used in sailing-vessels and moved by a tiller. The boiler was of the form then used in Watts's engines, and was set in masonry. The condenser was of the size used habitually in land engines, and stood, as was and still is the practice in them, in a large cold-water cistern. The weight of the masonry and the great capacity of the cold-water cistern diminished very materially the buoyancy of the vessel. The rudder had so little power that she could hardly be managed. The skippers of the river craft, who at once saw that their business was doomed, took advantage of the unwieldiness of the vessel to run foul of her as often as they thought they had the law on their side. Thus in several instances the steamer reached one or the other termini of its route with but a single wheel."

Before the season closed, the wheels were surrounded by a frame of strong beams and the paddles were covered in; the rudder was changed to the pattern such as is now used on all river boats and was worked by a wheel, the ropes from which were attached to the end most distant from the pintles. This rudder rendered the vessel manageable, and the beams placed around the wheel were capable of inflicting instead of receiving harm in a collision with sailing vessels.

During the winter of 1807–8 she was almost wholly rebuilt. The hull was considerably lengthened, and covered from stem to stern with a flush deck. Beneath this two cabins were formed, and surrounded by double ranges of berths, fitted up in a manner then unexampled for comforts, and the public taste was consulted in the application of numerous coats of rather gaudy paint. Thus improved, she commenced her trips for the season of 1808, and started regularly at the appointed hour, at first much to the discontent of travelers, who had before been waited for by sloops and stages.

At the end of the season she proved too small for the crowds who thronged to take passage.

The success of the "Clermont" led Fulton and Livingston to build two other vessels—viz., "The Car of Neptune" and the "Paragon," of three and three hundred and fifty tons respectively,—and add them to the line.[11] Fulton sent the following account of the first trip of the "Clermont" to the *American Citizen:*

[11] The name of the chief engineer of the "Clermont" on her first trip up-river has not been preserved; but Mr. Fulton, having had some difficulty with him, promoted Mr. Charles Dyck to his place on the return trip. Mr. Dyck was born in 1787 and died in 1871. While at Albany, a gentleman, Mr. Dyck said, came on board and engaged passage to New York. Mr. Fulton, on receiving his money, shed tears, remarking that it was the first that he had received for all his labor.

In 1818, Mr. Dyck was engineer on the "Car of Neptune," from New York to Albany, and also on the "Fire-Fly," from New York to Poughkeepsie. He was on the first steamer on the Ohio and Mississippi Rivers; also on the first steamboat on the Fulton Ferry line, and from New York to New Brunswick on the Philadelphia line with Captain Vanderbilt. For five years before his death he was blind.

"SIR,—I arrived this afternoon at four o'clock in the steamboat from Albany. As the success of my experiment gives me great hopes that such boats may be rendered of great importance to my country, to prevent erroneous opinions and to derive some satisfaction to the friends of useful improvements, you will have the goodness to publish the following statement of facts:

"I left New York on Monday at one o'clock, and arrived at Clermont, the seat of Chancellor Livingston, at one; time, twenty-four hours; distance, one hundred and ten miles. On Wednesday I left the chancellor's at nine in the morning, and arrived at Albany at five in the afternoon; distance, forty miles; time, eight hours.

"The run is one hundred and fifty miles in thirty-two hours,—equal to nearly five miles an hour. On Thursday, at nine o'clock in the morning, I left Albany, and arrived at the chancellor's at six in the evening. I started from thence at seven, and arrived at New York at four in the afternoon; time, thirty hours; space run through, one hundred and fifty miles,—equal to five miles an hour. Throughout my whole way, both going and returning, the wind was ahead. No advantage could be derived from my sail. The whole has therefore been performed by the power of the steam-engine, etc.

"ROBERT FULTON."

Fulton also wrote to a friend: "I overtook many sloops and schooners beating to windward, and parted with them as if they had been at anchor. The power of propelling boats by steam is now fully proved. The morning I left New York there were not thirty persons who believed that the boat would ever move one mile an hour or be of the least utility; and while we were passing off from the wharf, which was crowded with spectators, I heard a number of sarcastic remarks. This is the way in which ignorant men compliment what they call philosophers and projectors. Although the prospect of personal emolument has been some inducement to me, yet I feel infinitely more pleasure in reflecting on the immense advantages my country will derive from the invention."

The British *Naval Chronicle* for 1808 published an extract from a letter written by a gentleman of South Carolina, who was one of the favored few who were passengers on board the "Clermont" on her first trip. Under date *September 8th*, 1807, he says, "I have now the pleasure to state to you the particulars of a late excursion to Albany in the steamboat made and completed under the directions of the Hon. Robert R. Livingston and Mr. Fulton, together with my remarks thereon. On the morning of the 19th of August, Edward P. Livingston, Esq., and myself were honored with an invitation from the chancellor and Mr. Fulton to proceed with them to Albany in trying the first experiment up the river Hudson in the steamboat. She was then lying off Clermont, the

seat of the chancellor, where she had arrived in twenty-four hours from New York, being one hundred and ten miles. Precisely at thirteen minutes past nine o'clock A.M. the engine was put in motion, when we made head against the ebb-tide, and head wind blowing a pleasant breeze. We continued our course for about eight miles, when we took the flood, the wind still ahead. We arrived at Albany about five P.M., being a distance from Clermont of forty-five miles (as agreed upon by those best acquainted with the river), which was performed in eight hours without any accident or interruption whatever. This decidedly gave the boat upwards of five miles an hour, the tide sometimes against us, neither sails nor any other implement but steam used.

"The next morning we left Albany, with several passengers, on the return to New York, the tide in favor, but the wind ahead. We left Albany at twenty-five minutes past nine o'clock A.M., and arrived at Clermont in nine hours precisely, which gave us five miles an hour. The current on returning was stronger than when going up. After landing us at Clermont, Mr. Fulton proceeded with the passengers to New York. The excursion to Albany was very pleasant, and represented a most interesting spectacle. As we passed the farms on the borders of the river every eye was intent, and from village to village the heights and conspicuous places were occupied by sentinels of curiosity, —not viewing a thing they could possibly anticipate any idea of, but conjecturing about the plausibility of the motion. As we passed and repassed the towns of Athens and Hudson, we were politely saluted by the inhabitants and several vessels, and at Albany we were visited by His Excellency the Governor and many citizens. Boats must be very cautious how they attempt to board her when under way, as several accidents had nearly happened when boarding her. To board ahead will endanger a boat being crushed by the wheels, and no boat can board astern. The difference between the wake of 'Neptune's Chariot' and that of a common water-carriage is very materially open for observation, as when you approach the first you will be told by anticipation to pay respect to a lady in the 'Chariot,' as you will be readily notified by the expansion of a fan, which forms the dimensions of her wake, but moving with great impetuosity from the warm repulsion. It is a curious fan; it only spreads by an aquatic latchet, being sprung by the kicking of the horses. I may now venture to multiply and give you the sum-total. The boat is one hundred and forty-six feet in length and twelve feet in width (merely an experimental thing), draws to the depth of her wheels two feet of water, one hundred feet deck for exercise, free of rigging or any incumbrances. She is unquestionably the most pleasant boat I ever went in. In her the mind is free from suspense. Perpetual motion authorizes you to calculate on a certain time to land; her works move with all the facility of a clock, and the noise, when on board, is not greater than that of a vessel sailing with a good breeze."

June 29, 1878, the Philadelphia *Times* published a chat with the last and only survivor of the party on board the "Clermont," on her trial trip. This gentleman was the Rev. Frederic Reynolds Freeman, a Baptist clergyman, of Illinois, who was then on a visit to Philadelphia. He was carried in his mother's arms at the time, being only two years old. His personal remembrance of the event, of course, does not amount to much, but he has nevertheless a store of information concerning the trip not in the possession of anybody else, for as soon as he became old enough to realize the importance of the matter, he naturally sought with more assiduity than a person less directly interested would exhibit for facts pertaining to the occasion.

His father, Elisha Freeman, before retiring to a farm, was a sea captain, and for that reason was invited, with a small number of other persons, including municipal officials of Albany, to go aboard the "Clermont" upon its arrival. Captain Freeman went accordingly, taking with him his wife and little Freddy. "The event is like a dream to me," says Mr. Freeman. "Probably my memory would now be unable to reach it but for the constant rehearsals of the scenes and incidents made to me in my youth.

"When Columbus, prior to his voyage of discovery, walked the streets in Spain meditating upon his project, which had become generally known, men, and even small boys, would significantly point their fingers at their foreheads and exchange smiles. Just so was Robert Fulton treated before he turned the laugh upon a whole country of scoffers.

"The first steam packet was trim and handsome enough, excepting the boilers, machinery, and smoke-stack, which were rude, cumbrous, and of extremely formidable appearance.

"The side wheel was a clumsy affair, uncovered and with twelve huge paddles, held in their place by a ring half-way between their extremities and the hub, that sent water splashing upon the deck with every revolution. The top of the smoke-stack was about thirty feet above the deck,—nearly as high as the two masts, from the rear one of which floated the Stars and Stripes. Hours before she started a great multitude had assembled along the wharves to witness the expected inglorious ending of what was generally known as 'Fulton's Folly.' Cries of 'God help you, Bobby!' 'Bring us back a chip of the North Pole!' 'A fool and his money are soon parted!' etc., were frequent, loud, and annoying. Fulton, however, knew that the crowd were sincere in their ridicule, and with a confident smile went on superintending preparations for the start, as if he knew that triumph would presently more than overbalance the sneers, jibes, and cat-calls of the vulgar and the pitying manners of the more refined. Smoke issues from the stack; the hawser is drawn in; the side-wheel quivers; it slowly revolves; Fulton's own hand at the helm turns out the bow; he is pale, but still confident and self-possessed; the 'Clermont' moves out

into the stream, the ponderous machinery thumping and groaning, the wheel frantically splashing, and the stack belching like a volcano; the 'Clermont' steadily moves; all aboard swing their hats into the air and give a cheer that is immediately taken up by the entire multitude on land; the crowd remain cheering on the piers until the 'Clermont' is out of sight up the Hudson."

Mr. Freeman says that the boat arrived at Albany thirty-six hours after starting from New York. It had not been continually in motion, the party having stopped at the residence of Chancellor Livingston on the way up. The speed was at the rate of five miles an hour. The appearance of the strange vessel as she steamed up the river had a remarkable effect, even in daytime, upon the crews of craft passing by, for comparatively few of the skippers coming down could, in those days of slow mail and no telegraph, have been prepared to encounter such an oddity; but at night the "Clermont" spread consternation and terror on all sides. It was very dark, and the fires were fed with dry white-pine wood, which, when stirred, would send up columns of flame and sparks from the mouth of the tall stack. This apparent volcano, moving steadily through the darkness up the middle of the river, and accompanied by the rumbling and groaning of the hard-laboring machinery, was well calculated to strike terror into the hearts of sailors on the sloops and other craft coming down with grain and general farm produce, who had never heard of any motive power for vessels except wind, and who, withal, were extremely superstitious.

"My father and others told me," says Mr. Freeman, "that whole crews prostrated themselves upon their knees and besought Divine Providence to protect them from the horrible monster that was marching on the tides and lighting up its pathway by its fires."

When the members of the Freeman family went aboard the "Clermont," upon its arrival at Albany, Mrs. Freeman observed a workman emerging from the engine-room—a place very suggestive to her of the infernal regions—carrying in his hands a ladle filled with molten lead. With this he proceeded to stop up holes whose presence here and there in the rude machinery was indicated by escaping steam. Captain Freeman then learned that the workman had been busily employed doing the same thing ever since the "Clermont" had left New York. The people of Albany had been apprised of the arrival in advance, and the whole town turned out to receive Fulton and his steamboat, giving them an enthusiastic reception.

The "Clermont" had not been long under way on its first trial when Fulton ordered the engine stopped. Having observed that the paddle floats were too deeply immersed in the water, he shifted them nearer to the centre of the paddle, so that they did not enter so deeply into the water; and this alteration had the effect of increasing the speed of the vessel.

1808.—"It is a little curious," says Scott Russell, "that, although Fulton was the first in America, and Bell in Europe, to successfully avail themselves of the advantage of steam applied to navigation, it was in both cases *non longo intervello distanti*. Fulton was first in the race only a few days, and Bell by a few months."

"Robert L. Stevens is probably the man to whom, of all others, America owes the greatest share of its present highly-improved steam navigation. His father was associated with Livingston in his experiments previous to the connection of the latter with Fulton, and had persevered in his experiments during Livingston's absence in France. He is undisputedly the pioneer of steam-navigation on the open sea."

At the age of twenty he built a steamboat with concave water-lines—the first application of the wave-line to shipbuilding—and adopted a new method of bracing and fastening steamboats.

In conjunction with his father, John Stevens, the inventor, in 1807, he constructed a paddle-wheel steamer, which was in motion on the Hudson only a few days later than Fulton's first successful voyage. He called her the "Phœnix." Precluded by the monopoly which Fulton's success had obtained for him in the waters of New York, Mr. Stevens first employed her as a passage boat between New York and New Brunswick, and finally conceived the bold idea of carrying her under steam around Cape May to the Delaware, and so to Philadelphia, —a voyage which was successfully accomplished in June, 1809, he going around in command of the boat. A fierce storm overtook them; a schooner in company was driven to sea and absent many days, but the "Phœnix" made a harbor at Barnegat until the storm abated, when she continued on her voyage to Philadelphia, and plied for many years between that city and Trenton.[12] She was commanded by Captain Degraw, Robert L. Stevens was her temporary engineer, and was placed on the Delaware River for the purpose of carrying the New York passengers. She ran from Philadelphia to Bordentown, and made the passage thence, in 1812, in three hours when running with the tide, and in five hours against it. The boat had no wheel-house, and sometimes when in motion the water would be thrown as high as her smoke-stack. She belonged to what was called the Swiftsure Line, and attracted much interest. Her hour of departure was announced by the blowing of a long tin horn, and hundreds of persons would crowd the wharves to see her embark on her voyage. Passengers on this boat were landed in New York in 1812 some time during the following night if no accident occurred.

About 1816 Robert L. Stevens commenced steam ferriage between New York and the Jersey shore; in 1818 discovered the utility of employing steam expansively and using anthracite coal for fuel in steamers;

[12] The first English experiment in deep-sea navigation by steam was made by James Watt, from Leith to London, in 1818, ten years later.

in 1822 substituted the skeleton wrought-iron for the heavy cast-iron walking-beam; and in 1824 applied artificial blast to the boiler-furnace, and in 1827 the hog-frame to boats to prevent them from bending at the centre. In 1842 he was commissioned by the United States government to build an immense steam-battery for the defense of New York Harbor, which was left unfinished at the time of his death, April 20, 1856.[13]

1807–9.—A screw vessel was constructed at Providence, in 1807 to 1809, by Jonathan Nichols, a blacksmith, a native of Vermont, and David Griere, tailor, from Nantucket; she was about forty feet long, and worked by four horses. A small model boat had been before successfully worked. On June 24, 1807–8 or 1809, the craft went to Pawtuxet with a party to attend a Masonic gathering, and a happy couple to be married in that place. The trip to Pawtuxet was made in about two hours, but on the return the vessel, being destitute of a keel, drifted ashore in a thunder-squall, but was not much injured. A Boston mechanic afterwards bought her at a sheriff's sale, but while being towed home by a sloop was obliged to cut loose from her, and she went ashore and was totally lost in Buzzard's Bay.

1809.—"Steam," says the *Gentleman's Magazine* for December, 1809, under the head of AMERICA, "has been applied in America to the purpose of inland navigation with the greatest success. The passage boat between New York and Albany is one hundred and sixty feet long, and wide in proportion for accommodations, consisting of fifty-two berths, besides sofas, etc., for one hundred passengers; and the machine which moves her wheels is equal to the power of twenty-four horses, and is kept in motion by steam from a copper boiler eight or ten feet in length. Her route is a distance of one hundred and fifty miles, which she performs regularly twice a week, and sometimes in the short space of thirty-two hours."

Mr. Longstreet, of Augusta, Georgia,[14] is said this year to have invented a steamboat, on principles entirely different from any that had been constructed, for navigating the rivers of the Southern States.

This steamer was fifteen feet long by four broad, with a cylinder of four inches. It carried eight persons, and went at a uniform rate of six miles an hour.

The seventh vessel which was propelled by steam upon the Delaware arrived at Philadelphia, from Hoboken, New Jersey, in June,

[13] It was relinquished by the United States Government after a large sum of money had been expended upon its construction, and was willed by Mr. Stevens to the State of New Jersey, with an annual sum of money towards its completion. It has never been launched, the improvement in naval armament having rendered it useless for the purposes intended, and it has recently been sold at auction by the State of New Jersey. The purchaser will probably break the vessel up and utilize its material and engines.

[14] See notice of him under heading, 1790.

1809. This new steamboat was called the "Phœnix," and was the same built by John Cox Stevens, at Hoboken, in 1806, and intended as a passenger boat between New Brunswick and New York. But Fulton and Livingston having obtained from the State of New York an assignment or transfer of the rights of John Fitch under the law of March 19, 1787, securing to Fitch a monopoly in the nature of a patent for all boats and vessels navigated by fire and steam, Colonel Stevens found that employment of his boat in the waters of New York was restricted so much that it could not be made profitable. He therefore formed the design of sending the vessel to Philadelphia, as an assistant to the line of packets and stages upon the line to New York. This was a bold and hazardous experiment. The ocean had never been navigated by steam, and the power of the engines being limited the danger from storms seemed very great. But Robert L. Stevens, son of John Cox Stevens, the inventor, determined to risk the trial, and accordingly with a small crew he left New York. A fierce storm overtook them. A schooner in company was driven off to sea, and was kept out several days. The "Phœnix" made a harbor at Barnegat. After the storm subsided Stevens succeeded in bringing the boat around into the Delaware, and thus earned the distinction of having been the first man who ever navigated the ocean by steam. The first trip on the Delaware was made between Philadelphia and Trenton, July 5, 1809, there being nearly forty passengers on board. The "Phœnix" had "twenty-five commodious berths in her cabin and twelve in her steerage, with other ample accommodations for passengers." She was constructed with masts, so as to be able to take advantage of favorable winds and thereby add to the facility of her passages, and at the same time effect a saving in that important article,—fuel.

John C. Hamilton, a son of Alexander Hamilton, in 1878 wrote to the *Philadelphia Times:* "About the year 1809 I went to Washington City with my mother. Robert Fulton was in the stage with us, and we were all day getting to Princeton, where we were to start. Behind the stage Fulton had a submarine torpedo hitched on which he was taking to Washington. Fulton was a gentleman in mind and manners."

The first steamboat that ran on Lake Champlain was in 1809; she was called the "Vermont." Since that date up to 1870 about thirty different steamboats had been built and run upon the lake, the last of which, like the pioneer boat, is named "Vermont."

1811.—The Boston *Weekly Messenger* of November 8, 1811, under the head of RAPID TRAVELING, prints a letter from New York, dated October 24, which says, "The steamboat 'Car of Neptune,' which left this city on Saturday evening last at five o'clock, arrived at Albany in twenty hours. She returned this morning in twenty-two hours,—equal to *three hundred and thirty miles in forty-three*

hours! Let foreigners say we have no talent for improvement. Point out where there is a mode of conveyance equal to this! In what country are there so many enjoyments combined in one great polytechnic machine and mounted with wings as this which wafts passengers as by enchantment between the cities of New York and Albany? To our countrymen, then, and our arts let justice be honorably and honestly measured out."

In January of the same year Fulton had so little idea of the capacity and speed attainable by steam, that, in a letter to Dr. Thornton,[15] he says, "I shall be happy to have some conversation with you on your steamboat inventions and experience. Although I do not see by what means a boat containing one hundred tons of merchandise can be driven *six* miles an hour in still water, yet, when you assert perfect confidence in such success, there may be something more in your combinations than I am aware of. . . . If you succeed to run six miles an hour in still water with one hundred tons of merchandise, I will contract to reimburse the cost of the boat, and to give you one hundred and fifty thousand dollars for your patent; or, if you convince me of the success by drawings or demonstrations, I will join you in the expense and profits."

Within forty years five times the amount of merchandise was propelled by steam twenty miles an hour.

On the 17th of March, 1811, a steamboat built by Fulton and Swinston was launched at Pittsburg, Pennsylvania, under the superintendence of Mr. Robson, as the agent of Messrs. Fulton, Livingston & Co., of New York. She was a stern-wheel boat, and was the first steamboat ever run upon the Western waters of the United States. She was painted with a bluish-colored paint, and passed New Madrid, Missouri, at the time of the earthquake in December of that year. A Mr. Scowls, who in 1853 was a wealthy citizen of Covington, Kentucky, was a cabin-boy on board, Andrew Jack was the pilot, and a Mr. Baker the engineer. According to another account Charles Dyke was her engineer, and her first trip was in the winter of 1812.

In 1814 she carried General Coffee and Don Carol from Natchez, with troops, down to New Orleans to aid General Jackson in his defense of that city.

Audubon, in his Ornithological Biography, states, though not confidently, that the first steamboat that went down out of the Ohio to New Orleans was the "Orleans," commanded by Captain Ogden, in the spring of 1810. He is mistaken as to the date. When she first descended the Ohio she approached Louisville at midnight, and hundreds of Kentuckians, awakened by her demoniac screechings, rushed down the bank, believing the great comet of that year (1811) had fallen into the Ohio.

1811–12.—In 1811 and 1812 two steamboats were built, under Mr.

[15] Recently in the possession of Colonel Force, Washington.

Fulton's directions, as *ferry* boats for crossing the Hudson River, and soon after one of the same description for the East River. These boats were what are called twin boats; each having two complete hulls united by a deck or bridge. They were sharp at both ends and moved equally well with either end foremost, so that they crossed and recrossed without losing any time in turning about. He also, at the same time, contrived floating docks for the reception of these boats, and means by which they were brought to them without a shock. Fulton, in a publication respecting these ferry-boats, says of one, "She crosses the river, which is a mile and a half broad, when it is calm in fifteen minutes; the average time is twenty minutes. She has had in her at one time eight four-wheeled carriages, twenty-nine horses, and one hundred passengers, and could have taken three hundred more persons."

1812.—Prior to the practical working of any steamboat in Europe, Mr. Charles Brown had built for Fulton the following vessels:

NAME.	When Built.	Tonnage.	Length.	Breadth.	Depth.	Cylinder.	Stroke.	NOW EMPLOYED.
			feet.	feet.	feet.	inch.	feet.	
Clermont.....	1806	160	188	18	7	24	4	On the Hudson River.
Raritan.....	1807	120	.....	.....	.....	.....	.....	On the Raritan River.
Car of Neptune.....	1807	295	175	24	8	33	4.4	On the Hudson River.
Paragon.....	1811	331	178	27	9	32	4	On the Hudson River.
Jersey Ferry-Boat..	1812	118	78	39	7	20	4	By the Ferry Co.
Fire-Fly.....	1812	118	100	19	7	20	3.9	From New York to Newburgh.

After the "Phœnix," the next steamboat that ran up the Delaware was named the "Philadelphia." It was put on by the Union Line, and was commanded by Captain Jenkins. She ran from Philadelphia to Bristol, and afterwards established a wharf about three miles above, called "Van Hart's." Passengers thence took stages for New Brunswick and to New York in the "William Gibbons." For some reason, this boat always went by the name of "Old Sal,"—probably from a grotesque-looking female figure-head on her bow.

The next steamboat was the "Pennsylvania," and carried passengers for the Citizens' Line. The engine of this boat was subsequently placed in the old "Lehigh." Passengers by this line landed at Bordentown, and thence took coaches to Washington, New Jersey, where they were conveyed to New York on the steamer "Ætna," Captain Robinson. The following is one of the advertisements of this boat, dated March 23, 1818:

"THE STEAMBOAT ÆTNA

Leaves the upper side of Market Street daily, at 6 o'clock (after to-morrow), for Bordentown, touching up and down at Burlington, Bristol, and White Hill. *Passengers for New York, via* Bristol, will be conveyed thro' by sunset of same day, and by way of Bordentown, by noon next day."

Another advertisement of the same date announces

"THE STEAMBOAT BRISTOL OF BURLINGTON

Has commenced running for the season, leaving Bristol daily at half past seven A.M.; Burlington at eight A.M. (and in returning), Philadelphia at three P.M.

"N.B.—A Coach leaves Bristol for Trenton every day, immediately upon the arrival of this boat, and in the morning leaves Trenton in time for the passengers to proceed in her to Philadelphia. Fare to Trenton, $1.25."

And still another informs us that

"THE PHILADELPHIA & NEW YORK UNION LINE

Of steamboats, *via* Trenton and New Brunswick, connected by new carriages. 26 Miles by land. Fare, $4.50 through. Deck passengers, $3.50 through.

"Passengers leave the south side of Market Street wharf, in the Steamboat PHILADELPHIA, for Trenton, every day at 11 o'clock, lodge in New Brunswick, and arrive at New York in the Steamboat OLIVE BRANCH, the next day at 10 o'clock A.M. On her return the Philadelphia will leave Trenton at 6 o'clock A.M., and arrive at 10.

"The Hull and Engine of the Philadelphia have been thoroughly repaired. She will work under a very low pressure of steam, and will be managed by a careful and experienced Engineer."

The "Ætna" exploded her boiler in New York Harbor in 1824, having on board the Philadelphia passengers, and several lives were lost. Her place on the line was supplied by the steamboat "New York."

The Union Line then built the "New Philadelphia" to compete with the "New York," of the Citizens' Line, and then the "Trenton" came out to run against the "Pennsylvania," of the Citizens' Line. This line then built a new boat, and named it the "Philadelphia," to beat the "Trenton."

There was a wonderful competition among these lines for several years, when Captain Whilldin and Cornelius Vanderbilt started an opposition to them all. This was called the Dispatch Line, and the fare at one time was reduced to one dollar. The boat on this end was named the "Emerald." The Dispatch Line was soon disposed of, and the Union and the Citizens', with some of the others, afterwards became merged in the Camden and Amboy Railroad Company. The next boat was the "John Stevens," built at Hoboken in 1846, and destroyed by fire at Bordentown on the night of the 16th of July, 1855. The next was the "Richard Stockton," which ran between South Amboy and New York.

1810–19.—Mr. Hezekiah Bliss, who died at Brooklyn in 1876, made the acquaintance of Robert Fulton in 1810, then in the height of his fame as the pioneer of steamship navigation. Young Bliss was a frequent visitor at Fulton's home, and in his later years often spoke of the instruction that Fulton gave him. With his brain full of steamboats, young Bliss came to Philadelphia in the fall of 1811, and in the follow-

ing spring associated himself with Daniel French in the organization of a company to build a steamboat. They constructed a boat about sixty feet long by twelve feet wide, with an oscillating engine and stern wheel, which he judged the best adapted to avoid the driftwood that had proved a serious impediment to navigation in Western waters. The boat was for some time employed on a ferry between Philadelphia and William Cooper's landing.

In 1816, Mr. Bliss went to Cincinnati, and there in the following year he engaged, with the eldest son of General William H. Harrison, in the construction of steamboats. They built one, which they named "General Pike," in honor of General Zebulon Montgomery Pike, the father-in-law of young Harrison. It was one hundred feet long by twenty-five wide, and was the first boat ever built in Cincinnati, and the sixth on Western waters. The boat was first run in 1819.

Returning to New York in 1827, Mr. Bliss considered a flattering proposition to go to Mexico as an agent of the Barings of London, and soon afterwards, with Dr. Eliphalet Nott, formerly President of Union College, he engaged, in 1827–28, in experiments in steam navigation. In 1851 he established the since widely-known Novelty Works, with the view of constructing ocean steamers.—*Philadelphia Press.*

THE "COMET."—1812.—Stimulated, as he tells us, by the success of Mr. Fulton, with whom he was in correspondence,[16] Mr. Henry Bell, of Helensburgh, for many years a house-carpenter in the city of Glasgow, Scotland, determined, in 1812, to try the power of steam on the Clyde, and produced the first trading steam vessel in Europe.

Helensburgh is a watering-place on the river Clyde, and Mr. Bell, for several years preceding, had been the proprietor of a hotel and bathing-establishment there. It was to increase the facilities for reaching these baths that Mr. Bell first constructed his steamboat.

In those days there were no conveyances on the river except "fly boats," pulled by four oars or using sails when practicable; with these the voyage was sometimes made in five or six hours, but often the time was longer and uncertain. After various experiments with paddle-wheels driven by hand in place of oars, Mr. Bell was convinced, by the experiments of Millar and Symington and the success of Fulton, that steam power alone would effect his object. In consequence, after making several models of a steam vessel, he succeeded in one suited to his ideas, and contracted with Messrs. John Wood & Co., ship-builders, in Port Glasgow, to build a steam vessel after his model, to be forty feet on the keel and of ten feet six inches beam. He called

[16] Mr. Bell, in a letter dated March 1, 1824, says, "When I wrote to the American government on the great utility that steam navigation would be to them on their rivers, they appointed Mr. Fulton to correspond with me; so in that way the Americans got their insight from your humble servant."—*Memoir by Patrick Millar, Jr.*

her the "Comet," because built and finished the same year that a comet appeared in the northwest part of Scotland.

The "Comet" had two paddle-wheels, or rather two radiating sets of paddles, on each side, resembling very much in their appearance four malt shovels, radiating from a revolving axis to which they were all fixed. This was soon changed to Mr. Bell's complete wheel, which has been in use ever since. The engine known as the bell-crank, on Mr. Watt's principle, was put up under Mr. Bell's superintendence. The boiler was every way inferior to the boilers of Millar, Taylor, and Symington, inasmuch as the fire was on the outside of the boiler, separated from the wood of the vessel only by the bricks in which it was set, while in theirs, as in all steam vessels of the present day, the fire was wholly within the boiler, and surrounded by water, so as to prevent danger from accident by fire or loss of heat. The boiler, which was fed by a cistern of fresh water, was on one side of the engine, the funnel being bent to the centre of the boat, where it served the purpose of a mast to carry sail. The early constructors of steamboats endeavored to disguise the odious funnel under the designation of a main-mast, and some went so far as to raise up a top-mast in the thick folds of the dense, black smoke.

The "Comet" began to ply from Glasgow to Helensburgh in January, 1812, making a speed of about five miles an hour. She was of about twenty-five tons burthen, and her engine exerted a force of about *three* horse-power. She continued during the summer to ply successfully as a passenger boat.

The following is a copy of the original advertisement:

"STEAM PASSAGE BOAT. THE COMET. Between Glasgow, Greenock, and Helensburgh, for passengers only. The subscriber having, at much expense, fitted up a handsome vessel to ply upon the RIVER CLYDE BETWEEN GLASGOW AND GREENOCK, to sail by the power of wind, air, and steam, he intends that the vessel shall leave the Broomielaw on Tuesdays, Thursdays, and Saturdays, about midday, or at such hour thereafter as may answer from the state of the tide; and to leave Greenock on Mondays, Wednesdays, and Fridays, in the morning, to suit the tide.

"The terms are for the present fixed at 4s. for the best cabin and 3s. for the second; but, beyond these rates, nothing is to be allowed to servants or any other person employed about the vessel.

"The subscriber continues his establishment at HELENSBURGH BATHS the same as for years past, and a vessel will be in readiness to convey passengers in the Comet from Greenock to Helensburgh.

"Passengers by the Comet will receive information of the hours of sailing by applying at Mr. Housten's office, Broomielaw; or Mr. Thomas Blackney's, East Quay Head, Greenock.

"Helensburgh Baths, Aug. 5, 1812. HENRY BELL."

THE "ELIZABETH."—1813.—The success of the "Comet" soon excited competition, and three months after she began to ply upon the Clyde, in March, 1812, the keel of a rival was laid, and in March, 1813, the "Elizabeth," the second steamer on the Clyde, was started,

and continued to ply successfully, eclipsing the "Comet" and bringing much profit to the owner. This was probably the first remunerating steam vessel in the world.

Mr. Bell had employed in his experiments on fly-boats an engineer named John Thomson, of Glasgow, who appears to have assisted in planning his first boat, and to have felt himself ill-treated by Bell in not being made a partner in that speculation. To avenge his wrong, he got Mr. Wood, who built the "Comet," to build a vessel fifty-one feet keel, twelve feet beam, and five feet deep. The tonnage of this vessel was about thirty-three tons, and her power about ten horses. The correct proportion of power to tonnage seems to have been the secret of her success.

The owner's description of this vessel is an interesting and characteristic memorial of early steam navigation:

"The 'Elizabeth' was started for passengers on the 9th of March, 1813, and has continued to run from Glasgow to Greenock daily, leaving Glasgow in the morning and returning the same evening. The passage, which is twenty-seven miles, has been made, with a hundred passengers on board, in something less than four hours, and in favorable circumstances in two and three-quarters. The 'Elizabeth' has sailed eighty-one miles in one day, at an average of *nine miles an hour*. The 'Elizabeth' measures aloft fifty-eight feet; the best cabin is twenty-one feet long, eleven feet three at amidships, and nine feet four inches aft, seated all round, and covered with handsome carpeting. A sofa, clothed with marone, is placed at one end of the cabin, and gives the whole a warm and cheerful appearance. There are twelve small windows, each finished with marone curtains with tassels, fringes, and velvet, cornices ornamented with gilt ornaments, having altogether a rich effect. Above the sofa there is a large mirror suspended, and on each side bookshelves are placed containing a collection of the best authors for the amusement and edification of those who may avail themselves of them during the passage; other amusements are likewise to be had on board.

"The engine stands amidships, and requires a considerable space in length and all the breadth of the vessel. The forecastle, which is rather small, is about eleven feet six by nine feet six inches, not quite so comfortable as the after one, but well calculated for a cold day, and by no means disagreeable on a warm; all the windows in both cabins are made in such a way as to shift up and down like those of a coach, admitting a very free circulation of fresh air. From the height of the roofs of both cabins, which are about seven feet four inches, they will be extremely pleasant and healthful in the summer months for those who may favor the boat in parties of pleasure.

"Already the public advantages of this mode of conveyance have been generally acknowledged; indeed it may without exaggeration be said

that the intercourse through the medium of steamboats between Glasgow and Greenock has, comparatively speaking, brought those places ten or twelve miles nearer each other. In most cases the passages are made *in the same time as by the coaches;* and they have been, in numerous instances, done with greater rapidity. In comparing the comfortableness of these conveyances, the preference will be given decidedly to the steamboat. Besides all this, a great saving in point of expense is produced; the fare in the best cabin being only four shillings, and in the inferior one two shillings and sixpence, whereas the inside of a coach cost not less than twelve shillings and the outside eight shillings."

The "CLYDE," a third vessel, was built by Mr. Wood the same year for Mr. Robertson, an engineer of Port Glasgow, and commenced her trips in July. She was seventy feet on the keel, seventy-six feet long on deck, thirteen to fourteen feet beam, of fourteen horse-power, and sixty-nine tons measurement. Her speed was six miles an hour.

The "GLASGOW," a fourth vessel, was also launched by Mr. Wood in 1813, seventy-two feet long, fifteen feet beam, seventy-four tons measurement, and sixteen horse-power. Her engines were constructed by Mr. Cook, of Glasgow. She was intended to carry goods as well as passengers, and was moderately sharp, but afterwards improved by lengthening the bow five feet, and giving it greater sharpness. This vessel belonged to the first joint stock company for steam navigation ever established.

1809–13.—In 1809 the first steamboat was launched on the St. Lawrence. The *Quebec Mercury* of that date says concerning her:

"On Saturday morning, at eight o'clock, arrived here from Montreal, being her first trip, the steamboat 'Accommodation,' with ten passengers. This is the first vessel of the kind that ever appeared in this harbor. She is continually crowded with visitants. She left Montreal on Wednesday at two o'clock; so that her passage was sixty-six hours, thirty of which she was at anchor. She arrived at Three Rivers in twenty-four hours. She has at present berths for twenty passengers, which next year will be considerably augmented. No wind or tide can stop her. She has seventy-five feet keel, and is eighty-five feet on deck. The price for a passage up is nine dollars, and eight down, the vessel supplying provisions. The great advantage attending a vessel so constructed is that a passage may be calculated on to a degree of certainty in point of time, which cannot be the case with any vessel propelled by sails alone. The steamboat receives her impulse from an open, double-spoked perpendicular wheel on each side, without any circular band or rim. To the end of each double spoke is fixed a square board, which enters the water, and by the rotary motion of the wheel acts like a paddle. The wheels are put and kept in motion by steam operating within the vessel. A mast is to be fixed in her for

the purpose of using a sail when the wind is favorable, which will occasionally accelerate her headway."

In the spring of 1813 a second boat, of increased dimensions, called the "Swiftsure," was launched from the banks of the St. Lawrence. She was one hundred and thirty feet in length of keel, and one hundred and forty feet on deck, with twenty-four feet beam, and, according to the *Mercury*, made the passage from Montreal to Quebec in twenty-two hours, notwithstanding that the wind was easterly the whole time, and blowing strong.

The "Swiftsure" beat the most famous of the sailing-packets on the river fourteen hours in a race of thirty-six hours, but her owners seem not to have been very confident of her movements under all circumstances, or of the number of passengers who would patronize her, for she was advertised to "Sail as the wind and passengers may suit."

1810–21.—The first steamboat of which we have any record, in connection with India, was built at Batavia soon after the conclusion of the Java war, in 1810–11. The "Van der Capellen," as she was called, was built at the expense of English merchants. She was employed by the government for two years at the rate of ten thousand dollars a month, which well repaid her original outlay. She proved very effective for the transport of troops, etc. After some years she came into the possession of Major Schalch, and was used by him, under the name of the "Pluto," in 1822, as a dredging-boat. Then she went to Arraken as a floating battery. Finally she was lost, in 1830, in a gale.

In 1819, Mr. W. Trickett built at the Butterley Works a small steamboat of eight horse-power, for the Nawâb of Oude, to ply on the Jumna.[17]

In 1821 the "Diana" was sent out for a Mr. Roberts, intended for employment on the Canton River. She had a pair of sixteen horse-power engines. At Calcutta she was nearly reconstructed by Messrs. Kyd & Co., and launched again July 12, 1823, after which she was purchased by the Bengal government and dispatched to Amarapura, five hundred miles up the river Irrawaddy, with Mr. Crawford, then the Resident in Burmah. She sailed in September, when that river is at its fullest, and her progress, which did not exceed thirty miles a day, was a disappointment to the Indian government. The water having fallen when she returned in December the navigation was intricate, and her passage down was also tedious.

1812–14.—The "Comet," progenitor of all the Clyde and English steamboats, was wrecked in 1825 in the Firth of Clyde on a return trip from the Western Highlands, and many of her passengers were drowned. Bell, her originator, became as great a wreck as his vessel, and the Clyde trustees, out of gratitude, settled on him an annuity of

[17] Early Steam Navigation to India, by G. A. Prinsep, Calcutta, 4to, 1830.

one hundred pounds, which he enjoyed until he died, in 1830. His widow died in 1856, aged eighty-six.[18]

In 1813 a steamer was launched at Manchester and another at Bristol. October, 1814, the first steamer was in operation on the Humber, and in December the first steamer on the Thames was put in motion on the canal at Limehouse. June 28, 1815, a steamboat, built on the Clyde, arrived and was placed on the Mersey. On her passage she called at Ramsey, Isle of Man. She is notable as the first steamer which plied on the Mersey, but also as the pioneer of that noble fleet of steamers which ply with regularity between Liverpool and the numerous ports of the English, Irish, and Scotch coasts, also from being the first steamer to encounter the passage of these coasts.

About 1814 two vessels, "The Princess Charlotte" and the "Princess of Orange," were built and experimented with on the Clyde by a man named Miller, and proved unsuccessful. Watt & Bolton were the engineers.

The *seventh* steamer built on the Clyde was launched by William Fyle, May, 1814, and called the "Industry." She was of only fifty-four tons register. After an honorable career she lay a long time sunk in the East India harbor at Greenock, but November, 1872, was floated, beached, and calked, and in 1876 was presented by Messrs. Steele & Co., Catskill, her owners, to the Glasgow Chamber of Commerce, to be preserved as a memento of the early days of steam navigation, being beyond doubt the oldest steamboat in the world.

In 1815 ten steamboats were plying from the Clyde for the conveyance of passengers. The success of the steam-vessels at Glasgow soon excited attention elsewhere, and several Clyde-built vessels were purchased as models. A Mr. Lawrence, of Bristol, established a steamboat on the Severn, and, having carried her to ply on the Thames, the Company of Watermen made such opposition he was obliged to take her back to Somersetshire.[19]

Employment of Steamers in the War 1812–14.—The *Gentleman's Magazine* for April, 1814, in an article on "Steam Engine Passage Boats," says, "For the information of those who are unacquainted with the fact, it may be necessary to state that the principal rivers of North America are navigated by steamboats; one of them passed two thousand miles on the great river Mississippi in twenty-one days at the rate of five miles an hour against the descending current, which is perpetually running down. This steamboat is one hundred and twenty-five feet in length, and carries four hundred and sixty tons at a very shallow draft of water,—only two feet six inches,—and conveys whole ships' cargoes into the interior of the country, as well as passengers.

"The city of New York alone possesses *seven* steamboats for com-

[18] Notes and Queries, vol. iv., 2d Series.

[19] Buchanan's "Practical Treatise on Propelling Vessels by Steam."

merce and passengers. To name only one or two of them, that from thence to Albany, on the North River, passes one hundred and thirty miles; then (after about forty-five miles of land-carriage to Lake Champlain) you enter another steamboat that will take you about two hundred miles to near Montreal, between which place and Quebec a British steamboat one hundred and forty feet in length[20] is constantly passing, and usually goes down in twenty-eight hours, but sometimes in only twenty-four, although the distance is one hundred and eighty miles, and returning she is seldom more than twelve or fifteen hours additional time, though the stream is almost constantly running against her with great velocity so peculiar to the river St. Lawrence of North America. This boat in the last year was found of the greatest service to the British government in carrying troops and stores with greater ease and dispatch than can possibly be effected by land; and it is here worthy of remark that in the late expedition of Admiral Sir John Borlase Warren up the Potomac River, chasing the enemy, they, keeping their ships at a prudent distance from ours, *sent one of their steamboats* directly against the wind, so as to be just without gun-shot, and reconnoitered our fleet. This fact is mentioned *because it is presumed that it is the first instance where they have been applied to such purposes.*

"The steamboats used at present in our own island are a sufficient demonstration of their utility; it will be only necessary to mention those working on the river Braydon between Yarmouth and Norwich, and on the river Clyde between Glasgow and Greenock; which boats on this latter station often beat the mail between the two places, and are always certain to time, let the wind and tide be what they may.

"It would occupy too considerable a space in this paper to enter into the merits of those steamboats now building and preparing on the rivers Tyne, Thames, and Medway, particularly those with patent and simplified apparatus for the use of rivers, to pass coastwise, and for short runs of passages to the Continent; but it is necessary to state from most mature and deliberate examination that some of these steamboats with patent apparatus are so constructed that they can carry sail, and perform all the manœuvres of other vessels at sea, when the wind is in their favor, and when against them by furling their sails pass right in the wind's eye with velocity, thus continuing their passages in a straight line, while other vessels are obliged to tack to and fro."

In October, 1814, the first steamboat on the Humber was started to run between Hull and Gainsborough. She was called the "Caledonia," and accomplished, with a favorable tide, fourteen miles an hour.

In 1814 the "Margary" was taken south, along the east coast of Scotland. When she reached the Thames she passed close along the English fleet at anchor. Her extraordinary apparition excited a commotion among officers and men; none of them had seen a steamer before;

[20] The "Swiftsure." See *ante*.

by some she was taken for a fire-ship. The nearest man-of-war hailed her, and on being answered that she was a steamer built at Dumbarton, on the Clyde, a seaman named John Richardson, from Dumbarton, who was alive in 1857, ran along the deck of the man-of-war shouting "Hurrah for Scotland! Dumbarton forever!" The "Margary" was fifty-six feet long and nineteen feet in breadth over all. On leaving for London she was taken through the Forth and Clyde Canal, and coasted up to London.[21]

The claims of the "Margary" conflict somewhat with those of the "Caledonia," but the "Margary" was launched June, 1814, according to Cleland's "Annals of Glasgow," published in 1816, and went to London November, 1814, while the same annals say the "Caledonia" was not launched until April, 1815, and did not go to London until May, 1816. According to Cleland, twenty steam-vessels of various dimensions were built at Port Glasgow, Greenock, and Dumbarton with engines of Glasgow make during the four years 1812–16. Of these the "Elizabeth," launched November, 1812, went to Liverpool in 1814; "Argyle," launched in June, 1814, went to London in 1815; "Margary," launched June, 1814, went to London November, 1814; "Caledonia," launched April, 1815, went to London May, 1816; "Greenock," launched May, 1815, went to Ireland, and then to London May, 1816.[22]

A Margate hoy of large dimensions, propelled by steam, was, in 1815, said to be run constantly from London to Margate, and "from its novelty, and the certainty of its arrival within a given time (about twelve hours), it is much crowded with passengers." This was probably the "Margary."

Mr. Martin, the harbor-master of Ramsgate, who commanded a sailing-packet from Margate to Ramsgate, says that in June, 1815, on one of his trips, his companions pointed out to him an object some distance ahead, which they supposed to be a vessel on fire, but as they neared it was discovered to be the steamboat "Margary," *alias* "Thames."[23] With a fresh breeze he sailed round her easily, as her engine was of only fourteen horse-power, and her model a clumsy one. Nothing could exceed the ridicule his passengers bestowed upon the unseemly vessel; some compared her to a jaded horse with a huge pair of panniers, others to a smoke-jack. Yet this vessel had voyaged from Port Glasgow to Dublin, and from thence to London, and traversed fifteen hundred miles of sea, some part of it in tempestuous weather.

THE "DEMOLOGOS," OR "FULTON THE FIRST."

1814–29.—*The first War Steamboat.* Near the close of the year 1813, Robert Fulton exhibited to the President of the United States

[21] *Dumbarton Herald*; also the *Greenock Advertiser*, May 12, 1857.
[22] London Notes and Queries, vol. v., 2d Series.
[23] Another gives the name of the "Argyle" to the "Thames."

the drawing of a proposed war steamer or floating battery, named by him the "Demologos."

He contemplated, in addition to the proposed armament on deck, she should be furnished with four submarine guns, two suspended at each bow, to discharge a hundred-pound ball into an enemy ten or twelve feet below her water-line, and that she should have an engine for throwing an immense column of hot water upon the decks or through the ports of an opponent. Her estimated cost was three hundred and twenty thousand dollars, which was about the cost of a first-class sailing frigate.

Fulton's project was favorably received, and in March, 1814, a law authorised the President to cause to be equipped "one or more floating batteries for the defense of the waters of the United States."

The construction of the vessel was committed by the "Coast and Harbor Defense Association" to a sub-committee of five gentlemen, recognized by the government as their agents.

Robert Fulton, whose soul animated the enterprise, was appointed the engineer, and on the 20th of June, 1814, the *keels* of this novel steamer were laid at the ship-yard of Adam & Noah Brown, in the city of New York. The blockade of our coast by the enemy enhanced the price of timber, and rendered the importation of copper, lead, and iron and the supply of coal from Richmond and Liverpool difficult; these obstacles were, however, surmounted, and the enemy's blockade only increased the expense of her construction. With respect to mechanics and laborers there was also difficulty; shipwrights had repaired to the lakes in such numbers that comparatively but few were left on the sea-board; besides, a large number had enlisted as soldiers. By an increase of wages, however, a sufficient number of laborers were obtained; and the vessel was launched on the 29th of October, 1814, amid the hurras of assembled thousands.

The river and bay were filled with steamers and vessels of war in compliment to the occasion. In the midst of these was the floating mass of the "Demologos," or "Fulton," as she was afterwards named, whose bulk and unwieldy form seemed to render her as unfit for motion as the land batteries which were saluting her.[24]

Captain David Porter, writing the Secretary of the Navy under date New York, Oct. 18, 1814, says, "I have the pleasure to inform you that the 'Fulton the First' was this morning safely launched. No one has yet ventured to suggest any improvement that could be made

[24] A large copper-plate engraving of the launch of the "Fulton" is in the possession of the New England Historical and Genealogical Society. It is entitled "Launch of the Steam-Frigate 'Fulton the First,' at New York, Oct. 29, 1814; one hundred and fifty feet long, fifty-seven feet wide, mounting thirty long 32-pounders and two 100-pounders (columbiads). Philadelphia: Published March 27, 1815, by B. Tanner, 74 South Street. Drawn by I. I. Barralet, from a sketch by Morgan, taken on the spot.

in the vessel, and, *to use the words of the projector, 'I would not alter her if it were in my power to do so.'*

"She promises fair to meet our most sanguine expectations, and I do not despair in being able to navigate in her from one extreme of the coast to the other. Her buoyancy astonishes every one. She now draws only eight feet three inches of water, and her draft will be *ten* feet with all her guns, machinery, stores, and crew on board. The ease with which she can now be towed by a single steamboat renders it certain that her velocity will be sufficiently great to answer every purpose, and the manner it is intended to secure her machinery from the gunners' shot leaves no apprehension for its safety. I shall use every exertion to prepare her for immediate service. Her guns will soon be mounted, and I am assured by Mr. Fulton that her machinery will be in operation in about six weeks."

On the 21st of November, 1814, the "Fulton" was moved from the wharf of Messrs. Brown, on the East River, to the works of Robert Fulton, on the North River, to receive her machinery. The steamboat "Car of Neptune" made fast to her port and the steamboat "Fulton" to her starboard side, and so towed her to her destination at the rate of three and a half to four miles per hour.[25]

The dimensions of this, the *first war steamer*, were: Length, 150 feet; breadth, 56 feet; depth, 20 feet; water-wheel, 16 feet diameter; length of bucket, 14 feet; dip, 4 feet; engine, 48-inch cylinder, 5-feet stroke; boiler, length 22 feet, breadth 12 feet, and depth 8 feet. Tonnage, 2475. She was the largest steamer that had been built, by many hundreds of tons, at the time of her launch.

The commissioners appointed to examine her say in their report,—

"She is a structure resting upon two boats, keels separated from end to end by a canal fifteen feet wide and sixty-six feet long. One boat contains the caldrons of copper to prepare her steam. The vast cylinder of iron, with its piston, levers, and wheels, occupies a part of its fellow; the great water-wheel revolves in the space between them; the main or gun-deck supporting her armament is protected by a bulwark *four feet ten inches thick, of solid timber*. This is pierced by thirty port-holes, to enable as many 32-pounders to fire red-hot balls; her upper or spar-deck, upon which several thousand men might parade, is encompassed by a bulwark which affords safe quarters. She is rigged with two short masts, each of which supports a large lateen yard and sails. She has two bowsprits and jibs and four rudders, two at each extremity of the boat; so that she can be steered with either end foremost. Her machinery is calculated for the addition of an engine which will discharge an immense column of water, which it is intended to

[25] It is stated in "Rees's Encyclopedia" that she was towed on this occasion by the "Paragon," of three hundred and thirty-one tons burden, at the rate of four miles an hour.

throw upon the decks and through the ports of an enemy. If, in addition to all this, we suppose her to be furnished, according to Mr. Fulton's intention, with 100-pounder columbiads, two suspended from each bow, so as to discharge a ball of that size into an enemy's ship ten or twelve feet below the water-line, it must be allowed that she has the appearance at least of being the most formidable engine of warfare that human ingenuity has contrived."

Such is a correct description of this sea-monster of 1814, but exaggerated and fabulous accounts of her got into circulation. Among others, the following was published in a Scotch newspaper, the writer stating that "he had taken great care to procure full and accurate information."[28]

"Her length," he writes, "on deck is *three hundred feet;* thickness of sides, *thirteen feet*, of alternate oak plank and cork-wood; carries 44 guns, four of which are 100-pounders; and further to annoy an enemy attempting to board can discharge one hundred gallons of boiling water in a minute, and by mechanism brandishes *three hundred cutlasses* with the utmost regularity over the gunwales; works also an equal number of heavy iron pikes of great length, darting them from her sides with prodigious force, and withdrawing them every quarter of a minute."

The stores of artillery at New York not furnishing the number and kind of cannon she was to carry, guns were transported from Philadelphia, a prize having placed some excellent pieces at the disposal of the Navy Department. To avoid the danger of their capture, twenty of these guns were sent over the miry roads of New Jersey dragged by horses.

In consequence of the exhaustion of the treasury and temporary depression of the public credit, the commissioners were instructed to pay the bills for the "Fulton" in treasury notes, but solely at par. These notes were often so long withheld that those who had advanced materials and labor were importunate for payment, and the commissioners had frequently to pledge their private credit. Once the men discontinued work. From these causes her completion was retarded until winter, and also by the unexpected death of Mr. Fulton, on the 24th of February, 1815.

All difficulties at length being surmounted, the machinery was put in motion, and she made her first trial trip on the 1st of June, 1815, nine months after her keels were laid. On this trial she was found capable of opposing the wind, of stemming the tide, of crossing currents, and of being steered among vessels riding at anchor, though the weather was boisterous and the water rough. Her performance demonstrated the success of Fulton's idea, and that a floating battery composed of heavy artillery could be moved by steam.

[28] Stuart's "War and Mail Steamers" gives accurate drawings of the "Fulton" from the originals; and there is a drawing of her in *Harper's Magazine.*

She left the wharf near the Brooklyn ferry, propelled by steam alone, against a stiff south breeze (which was directly ahead), and a strong ebb tide, and steamed by the forts, saluting them with her guns, her speed equaling the most sanguine expectations.

After circumnavigating the bay and receiving a visit from the officers of a French ship-of-war, she came to anchor at Powles' Hook ferry about two P.M., nothing occurring to mar the pleasure or success of the trip. It was discovered, however, that alterations were necessary, some errors to be corrected, and some defects to be supplied, before she was prepared for a second trial.

On the 4th of July, 1815, she again made a trip to the ocean, eastward of Sandy Hook, and back again, a distance of fifty-three miles, in eight hours and twenty minutes, without the aid of sails, the wind and tide being partly favorable and partly against her, the balance rather in her favor. The gentlemen who witnessed this experiment, without exception entertained no doubt as to her fitness for the intended purpose. Expedients were sought to increase her power, and devised and executed for quickening and directing her movements.

A third trial of her powers was attempted, on the 11th of September, with twenty-six of her long and ponderous guns and a considerable quantity of ammunition and stores on board. Her draft of water was less than eleven feet. She changed her course by reversing the motion of her wheels, without the necessity of putting about, like the ferry-boats of the present day. She saluted as she passed the forts, overcame the resistance of the wind and tide in her progress down the bay, and performed beautiful manœuvres around the U. S. Ship "Java," then at anchor near the light-house. She moved with remarkable celerity, and was perfectly obedient to her double helm. The explosion of powder produced very little concussion on board, and her machinery was not affected by it in the slightest degree. Her progress during the firing was steady and uninterrupted. On the most accurate calculation, her velocity was four and a half miles an hour, and she made headway at the rate of two miles an hour against the ebb of the East River, running three and a half knots. The day's exercise was satisfactory to the company on board beyond their most sanguine expectation, and it was universally conceded that the United States possessed a new auxiliary against every maritime invader. The city of New York was considered as having the means of making itself invulnerable, and every bay and harbor of the nation might be protected by the same tremendous power. Her performance more than equaled Fulton's expectations, and it exceeded what he had promised the government, that she should be propelled by steam at the rate of from three to four miles an hour.

The commissioners who superintended her construction, congratulated the government and the nation on the event of this noble project, and said, "Honorable alike to its author and its patrons, it constitutes an

era in warfare and the arts. The arrival of peace indeed has disappointed the expectations of conducting her to battle. That best and conclusive act of showing her superiority in combat has not been in the power of the commissioners to make.

"If a continuance of tranquillity should be our lot, and this steam-vessel of war be not required for the public defense, the nation may rejoice in the fact we have ascertained is of incalculable greater value than the expenditures, and that if the present structure should perish, we have the information, never to perish, how, in any future emergency, others may be built. The requisite variation will be directed by circumstances."

The war having terminated, "Fulton the First," after these trial trips, was taken to the navy yard at Brooklyn and moored on the flats abreast of that station, where she was used as a receiving-ship until the 4th of June, 1829, fifteen years after the laying of her keels, when she was accidentally or purposely blown up.

Commodore Chauncey, reporting this catastrophe, says that he had been on board of her all the morning inspecting the ship and men, particularly the invalids, who had increased considerably from other ships, and whom he had intended asking the Department's permission to discharge as of little use to the service. He had left the ship but a few moments before the explosion took place. The report did not appear to him louder than a 32-pounder, although the destruction of the ship was complete and entire, owing to her very decayed state. There was on board at the time no more than *two and a half barrels of damaged powder*, kept in the magazine, for the morning and evening gun. By this explosion, however, twenty-four men and a woman were killed, nineteen wounded, and five reported as missing and probably killed. Among the killed was Lieutenant S. M. Breckenridge, and among the wounded Lieutenant C. F. Platt, who died a captain in the navy, Lieutenant A. M. Mull, and Sailing-Master Clough; Lieutenant Platt was dangerously, the others severely, wounded. Four midshipmen were among the wounded.

Commodore Chauncey was of opinion that "the explosion could not have taken place from accident, as the magazine was as well or better secured than the magazines of most of our ships; yet it is difficult to assign a motive to those in the magazine for so horrible an act as voluntarily to destroy themselves and those on board, yet, if the explosion was not the effect of design, I am at a loss to account for the catastrophe."

Master Commandant John T. Newton,[27] her commander, was on shore at the time of the explosion. Such was the beginning, end, and uneventful history of the first steam-vessel of war ever put afloat,—

[27] Captain Newton also commanded the "Missouri" when she was burned in Gibraltar bay, 1844.

the pioneer, and to an extent the model also, of the floating batteries, double-hulled vessels, and "double-enders" which have succeeded her.

1815.—The "British Naval Chronicle" for July, 1815, says, "The 'Thames' steam yacht is said lately to have accomplished a voyage of fifteen hundred miles. She twice crossed St. George's Channel and sailed round Land's End, and is the first *steam*-vessel that ever traversed these seas. The advantages of a vessel enabled to proceed either by sail or steam, or both united, must indeed be sufficiently obvious, and especially in the certainty of reaching its place of destination in a given time."

The Hampshire *Telegraph*, June, 1815, notices a steam-vessel which, it says, "suddenly made its appearance lately at Portsmouth, England, and, coming into the harbor immediately against the wind, produced a considerable degree of curiosity. She was a very neatly fitted vessel, and goes through the water at the rate of seven or eight miles an hour, which is produced by the steam from an engine of fourteen horse-power; one ton of coal is sufficient fuel to produce the necessary force of steam for impelling her one hundred miles. She came from Plymouth Sound in twenty-three hours. It was intended, had the wind not been fair, that she should have towed the 'Endymion' frigate out of the harbor;" the "Endymion" being the vessel which was on the coast of the United States during the war of 1812–14, and had the credit of receiving the surrender of the U. S. Frigate "President."

These notices undoubtedly refer to the "Argyle," launched on the Clyde June, 1814, and, having been renamed the "Thames," rendered ever memorable from being the first steamboat to make an extended sea-voyage in British seas.

The "Argyle," or "Thames," was seventy tons register, seventy-nine feet long on the keel, had sixteen feet beam, and engines of fourteen horse-power. Her paddle-wheels were nine feet in diameter. She had two cabins,—one aft, the other forward of her engines. In her waist was the engine, the boiler on the starboard, the cylinder and fly-wheel on the port side. Her funnel did duty *as a mast*, and was rigged with a large square-sail. A gallery projected upon each side of the cabin, and formed a continuous deck. She had a row of eighteen painted ports on each side, with two astern, which were, to a casual observer, very formidable. After plying about a year between Glasgow and Greenock she was purchased by a London company, to be run between that city and Margate, and it became necessary to bring her by sea from the Clyde to the Thames.

There was then in London a man named Dodd, who had served in the navy, and had distinguished himself as an engineer and architect, but who finally, driven by misfortune to intemperance, almost literally died in the streets a beggar.

To this Dodd was intrusted the task of taking the "Argyle" from

the Clyde to the Thames, and he arrived in Glasgow in April, 1815, with a crew consisting of a mate, an engineer, a stoker, four seamen, and a cabin-boy; and with these put boldly to sea in the "Argyle" about the middle of May, 1815. His voyage at first was far from auspicious. The weather was stormy, the sea ran high in the strait which separates Scotland from Ireland, and, through ignorance, or negligence, or misunderstanding, the pilot during the night altered the course, and the vessel came near being wrecked. At break of day, a heavy gale blowing, it was discovered they were within half a mile of a rock-bound lee-shore, two miles north of Port Patrick. To attempt to beat off in the teeth of the gale by the united power of steam and sails Dodd found impossible. Depending, therefore, entirely on his engine, he laid the vessel's head directly to windward, and kept the log going. The vessel began slowly to clear the shore about three knots an hour. Having acquired a sufficient offing, he bore away for Loch Ryan, gained the Irish coast, and May 24 entered the Liffey.[28]

A very graphic, interesting, and detailed account of her voyage, written by Mr. Weld, the secretary and historian of the Royal Society, who with his wife took passage on board at Dublin, can be found in *Chambers's Journal* for April 25, 1857. It is too long to give entire in these notes.

Leaving the Liffey on Sunday noon, the 28th of May, 1815, many persons from curiosity crossed the bay in her and landed at Dunleary (now Kingstown), and, the sea being rough, the passengers were violently sea-sick. Several naval officers on board unanimously declared it to be their firm opinion that the vessel could not live long in heavy seas, and that there would be much danger in venturing far from shore. At Dunleary all the passengers except Mr. Weld and his wife left the boat, and it is to their brave resolve to remain that such a complete account of this pioneer voyage around the British Islands has been preserved.

The voyagers soon left behind them all the vessels which had sailed from Dublin with the same tide, and the next morning, when off Wexford, the dense smoke which issued from the mast-chimney being observed from the heights over town, it was concluded the vessel was on fire, and all the pilots put off to her assistance. Putting in at several intermediate ports, on the 6th of June, the adventurers arrived at Plymouth. The harbor-master, who had never seen a steamboat, was as much struck with astonishment when he boarded the "Thames" as a child in the possession of a new plaything. The sailors ran in crowds to the sides of their vessels as she passed, and, mounting the rigging of their vessels, gave vent to their observations in the most amusing manner.

On her arrival at Portsmouth thousands of spectators assembled to gaze upon her, and the number of boats that crowded around her was

[28] *Morning Chronicle*, June 15, 1815.

so great that it became necessary to request the port-admiral to assign the voyagers a guard to preserve order. A court-martial sitting on board the "Gladiator" adjourned its session to visit her, and, on the 10th of June, Sir Edward Thornborough, the Port-Admiral, sent his band and a guard of marines on board, and soon after followed himself, accompanied by *three* admirals, *eighteen* post-captains, and a large number of ladies. The morning was spent very pleasantly in steaming among the fleet and running over to the Isle of Wight, the admiral and the naval officers expressing themselves delighted with the "Thames."

From Portsmouth the steamer proceeded to Margate, which was reached Sunday, June 11, 1815. The next day she arrived at Limehouse, and was moored. They passed everything on the Thames,—all the fast-sailing Gravesend boats, pleasure-boats, West Indiamen, etc.

The whole distance sailed from Dublin to Limehouse was seven hundred and fifty-eight nautical miles, which were accomplished in one hundred and twenty-one and a half hours, with an expenditure of one ton of coal for every one hundred miles.

1815–16.—Steam navigation was adopted in Russia at an early date. Mr. Baird, superintendent of mines, made the first experiments in 1815, with an open boat of his own construction, fitted with a four horse-power engine, with which he made his first trip from St. Petersburg to Cronstadt and back on the 15th of November. In 1816 he built a steam-vessel of larger dimensions, with an engine of twenty horse-power, for conveyance of passengers between the two places. For twenty years he had the exclusive privilege of furnishing the Russian metropolis with steamboats for mercantile purposes. The first government steam-vessel, the "Rapid," was constructed at the Ishora yard in 1816, and was of thirty-two horse-power. The Neva was the first river in Russia on which steamboats were applied. The Caspian Sea, in 1844, was navigated by four steamboats, each of forty horse-power. The first steamboat introduced into Siberia was built in 1843, and employed on Lake Balkan. She was of thirty-two horse-power, and called the "Emperor Nicholas."

In the *American Daily Advertiser* of November 27, 1816, there appears the following notice of a new steamboat to run between New York and Baltimore, commanded by Captain Moses Rogers, who, three years later, further immortalized himself, in connection with steam navigation, by commanding the "Savannah," the first steam-vessel that ever crossed the Atlantic:

"NEW STEAMBOAT.—On Tuesday last the elegant steamboat 'New Jersey,' Moses Rogers master, sailed from this port for Baltimore. This boat is coppered completely, and furnished with powerful *copper boilers*. She is finished in a style superior to any ever built in this place; the workmanship of the main and ladies' cabins is executed with great taste and with every possible accommodation for passengers.

"Her engine was constructed by Mr. Daniel Large, of this city, engineer; it appears to be an improvement of the plan proposed by Mr. David Prentice, and exemplified in one of the ferry-boats on the Delaware. The cylinder is fixed upon an inclined plane, and the shafts of the two wheels are furnished with a crank common to both, which crank, by a connecting-rod, puts the fixtures of the cylinder and air-pump in motion without that tremor and noise which is so injurious to steamboats in general, and unpleasant to the passengers. Her speed, in the trials which have been made, exceeds that of the fastest boats at their commencement, and if she continues to improve she will be one of the most expeditious steamboats in the United States. No expenses have been withheld; every opportunity has been employed to fit her for the station in the line of steamboats for which she is intended, between *Baltimore and Elkton.* Captain Rogers was the *first who went to sea in a steamboat;* he navigated the 'Phœnix,' in 1809, from New York to Philadelphia; in 1813 he navigated the 'Eagle' from this port (New York) to Baltimore, and now, towards the close of November, he proposes to conduct this steamboat to the capes of the Delaware, and from thence to Baltimore, by way of Norfolk, in Virginia."

1816.—The following advertisement of Nicholas J. Roosevelt, claiming the invention of vertical paddle-wheels for steamers, and for which he obtained a U. S. patent in 1814, is from a Philadelphia newspaper dated March 16, 1816:

"STEAM BOAT NOTICE.

"ALL persons are hereby informed, that I claim the right of Inventor of Vertical Wheels, as now generally used for Steam Boats throughout the United States, having been first used, after my invention, in the *North River* Steam Boat, by Messrs. Livingston & Fulton.

"I have obtained a *Patent* in due form of law, for my invention, which is dated the 1st day of Dec. 1814.

"No other person in the United States has any *Patent*, but myself, for the invention of *Vertical Wheels.* Having obtained a *legal* title to the sole use of steam boats *with such wheels*, I hereby forewarn all persons from using them hereafter without license from me. The patent and evidence of my right are in the hands of Wm. Griffith, Esq., of the City of Burlington, my Counsel at Law.

"On this subject, so very important to me (being the only real and efficient invention since Fitch's Boat), I do not by this notice challenge controversy, but am prepared to meet it in any form. My object is to *make known*, that I am the inventor, and have the *Patent* right. Individuals or companies who use such wheels without my license after this, will be prosecuted under the Law of Congress, for damages amounting to the profits of the boat. Licenses will be sold under me at moderate rates, and warranted.*

"NICHOLAS J. ROOSEVELT.

"BURLINGTON, N. J., 4th March, 1816.

"* NOTE.—Although my Patent assures me a legal right, any person may be further satisfied of my just claim, by recurrence to the evidences in the hands of my Counsel at Law. They consist principally of *original* letters between Chancellor Livingston, Mr. Stevens, and myself, on this very thing, at *the time of my invention*, accompanied with depositions of many persons witnesses of, and knowing to the fact.

"N. J. R.

"March 15, 1816."

THE FIRST FERRY-BOAT.—The first steamer specially built at Liverpool for the purpose of a ferry was the "Etna," which in April, 1816, began to ply between Liverpool and Traumere. She was sixty-three feet long, with a paddle-wheel *in the centre*, her extremities being connected by beams, and her deck twenty-eight feet over all. This primitive vessel initiated the transit by the numerous ferry-boats which now bridge the Mersey.

March, 1816, the first steamboat crossed the English Channel from Brighton to Havre. The "Majestic," in 1816, built at Ramsgate, of —— tons, and engines of twenty-five horse-power, was considered a gigantic concern. Her crossing from Dover to Calais with two hundred passengers, and her return without accident, was a feat highly appreciated. This vessel established the ascendency of steamboats over other means of water conveyance. The sailing-packet between Margate and Ramsgate was often detained two days by calms and tides. The steamboat passed and repassed the sailing-packet loaded with passengers. On one occasion, the third night out, the packet was caught at anchor in a sudden northerly gale, and lost much of her gear, and the next day, while the gale was stronger, had the mortification of seeing the "Majestic" pass and convey her passengers into Margate.

The first line of steamboats from New York to New London, Connecticut, was established in 1816. On the 28th of September, 1816, the "Connecticut," Captain Bunker, arrived from New York in twenty-one hours,—which was regarded as a signal triumph for steam, the wind and the tide being against her. In October a regular line commenced making two trips per week to New Haven; the "Fulton," Captain Law, at the same time running between New York and New Haven. The price of passage was five dollars to New Haven, and from thence to New York four dollars.

Jonathan Morgan, Esq., of Wiscasset, Maine, afterwards a well-known and eccentric citizen of Portland, Maine, in 1816 ascended the Kennebec River by steam. In June, 1818, his boat, the "Alpha," of fifteen tons, was sold at "public vendue" by a constable of Wiscasset for eighty-seven dollars. The boat was a long narrow flat boat, and, the machinery being taken out, she was converted into a fishing-vessel. The steam-power was applied to a screw-propeller in the stern. Her boiler was built of pine plank, and about the size of a common molasses hogshead, into which was fixed a fire-box of iron. An endless chain connected the engine with her propeller. The machinery was invented and designed by Jonathan Morgan, who anticipated a fortune from its invention.

The first trip of the "Alpha" up the Kennebec was as far as Augusta. At Hallowell the boat halted, when many visitors inspected the strange craft. Mr. Morgan came on shore, and Page & Bemant,

to encourage the enterprise at first, made him a donation in money. Leaving the wharf, she was unable to stem the current, and was carried sidelong across the river and fell back to Clark's wharf, lower down. At last she gained sufficient headway to proceed up river to Augusta, where she was greeted with many cheers. Mr. Morgan, who removed to Portland in 1820, was so ashamed of his failure that he never wished to have it spoken of.

1816–19.—The first application of steam for the purpose of towing vessels—now an important and invaluable part of the numerous services rendered by steam to navigation—was made in October, 1816, when the "Harlequin" was towed out of the Mersey by the "Charlotte," a steamer which, in the summer of the same year, had been placed as a ferry-boat to run between Liverpool and Eastham.

In 1819, Mr. Rennie, who planned the breakwater at Plymouth, England, was the "advising engineer" to the Admiralty, and on every occasion urged the application of steam-power to vessels-of-war. He hired at his own cost the Margate steamboat "Eclipse," and successfully towed the "Hastings" 74 against the tide from Woolwich to Gravesend, June 14, 1819. In consequence of this feat, Lord Melville and Sir George Cockburn, R.N., urged the great value of steam-power for towing men-of-war.

The First Steamer to Newport, R. I.

1817.—The "Firefly."—On Monday, the 26th of May, 1817, the "Firefly," Captain Smith, arrived at Newport from New York. The sea was very rough as she rounded Point Judith, and she was twenty-eight hours in making the passage. She was intended to ply between Providence and Newport, and made her first trip to Providence on the 28th, leaving Newport at nine A.M. and reaching Providence about noon. A sloop brought news of the approaching steamboat, and long before noon the wharves were crowded with people awaiting the arrival of the strange craft. At last she came wheezing and puffing up the river to where the Crawford Street bridge now stands; then, turning about, ran up to her wharf and made fast. A gentleman doing business in the Arcade in 1877 remembered being held aloft in his father's arms to see the boat come in. He described the "Firefly" as an ugly little thing, full of machinery and awkward in her motions. The people cheered, however, and shouted and looked her over as we would now inspect a balloon just arrived from St. Petersburg.

June 28 the "Firefly," with Governor Knight, U. S. Marshal Dexter, and others on board, sailed at seven A.M. for Newport, to meet and escort President Monroe to Providence. He went, however, in a revenue cutter to Bristol, where he embarked on the "Firefly," reaching Providence about nine P.M. On landing he was received

by a salute of cannon and the ringing of bells. The next day he proceeded to Boston. On the 26th of July the "Firefly" made a "cherry" excursion to Fall River, two dollars being the charge for the fare and dinner.

The packet-masters resorted to every lawful means to break down the new enterprise. The "Firefly" was no match for a fast sloop with a favorable wind. She hoisted a huge square-sail when the wind was fair, but the packets would often come into port ahead. The packet captains even carried their opposition so far that they would stand upon the "Firefly's" wharf just before her hour of starting and offer to carry passengers to Newport for twenty-five cents, or for nothing if they did not get there in advance of the "Firefly." In this way in four months they succeeded in running her off.

Then the packetmen held a meeting on the packet wharf and denounced interlopers in striking and powerful language, after which they adjourned to a convenient packet and drank confusion to steamboats. Packets in those days furnished the best means of transportation between Providence and New York. The sailing of a mail-packet for New York aroused more attention than is now paid to the departure of an ocean steamship. Passengers came to the boat accompanied by relatives and friends. The master of the boat would bring out his stately decanters, and place a whole row of glasses on the mahogany table in the cabin. Then a solemn health would be drank to the prosperity of the voyage.

The packets were beautifully modeled, sloop-rigged vessels of from seventy-five to one hundred tons burden, built with a view to speed, carrying capacity, and comfort. The sides of some were adorned with bead-work; others had polished strips of hard pine let into the sides, and all were painted in gay and lively colors. The cabins were frequently finished and furnished with mahogany, and decorated in every imaginable way. These cabins averaged twelve feet square, and from them opened tiny state-rooms.

Packets sailed from Providence for New York every week; the trip was of varying length. The "Huntress" often came through in eighteen hours, but sometimes the voyage lasted a week. The fare was ten dollars, including meals. Over the cabin stairs hung a mahogany letter-box, and on arrival there would be a rush of people to the packet to get letters in advance of the slow mail plodding over the post-roads. As soon as the immediate business of landing was over, the captain would pour the contents of the letter-box upon the mahogany table, and after the distribution of letters the decanters were produced and everybody drank the captain's health. Captain Whipple Brown, one morning, unloaded from his sloop seven hundred and fifty thousand dollars in silver. There were five thousand dollars in a keg, and kegs enough to load fifteen baggage-wagons, which,

before sunrise, set out for Boston with two well-armed guards in charge of each wagon.[29]

Seventeen large steamboats were, in 1817, in constant employment on American rivers besides ferry-boats.

The steamboat "Massachusetts," in 1817, introduced steam navigation to Boston, Massachusetts. She was built in Philadelphia, and arrived at Boston early in June. She was owned by Joseph and John H. Andrews, William Fettyplace, Hon. Stephen White, and Andrew Watkins, of Salem, and Andrew Bell, of Portsmouth, New Hampshire, and was intended to run between Salem and Boston. She was of two hundred and thirty tons register, and had an engine of thirty horse-power. She made a few trips between Salem and Boston, but, not being well patronised, in the autumn, or early in the winter, was sent south to Charleston or Savannah, to be sold, and was lost on the passage on the coast of North Carolina. On her arrival in Salem she was called by the *Enterprise* the "Brilliant North Star." She made her first trip from Salem to Boston July 4, 1817, leaving Salem at eight A.M.; she arrived at Boston at eleven A.M., her greatest rate of speed being eight miles an hour. In consequence of some damage to her machinery, she did not return to Salem on that day, and her passengers were sent back in coaches. The next day she made a trip to Hingham and returned, making the trip in two hours each way. The enterprise proved more than a total loss to her proprietors. There was a distrust in the public mind in relation to her, and many who cried out against her were thought to be influenced by the stage companies.

The *Boston Daily Advertiser* July 4, 1817, announced, "We understand that the elegant steamboat 'Massachusetts' will be here this day at ten o'clock, and will take a few gentlemen and ladies for a few hours to sail about the islands in this harbor." This was beyond a doubt the first Fourth of July steamboat excursion in Boston harbor.

She seems to have been supplanted, in 1818, by the "Eagle," which filled her place as an excursion boat. The "Eagle" ran from Nantucket to New Bedford for six months, the same year.

1818.—One hundred and thirty-nine years after the launch of the first vessel, the "Griffin," of sixty tons, by La Salle, August 7, 1679, upon the Niagara River, between the Falls and Lake Erie, steam navigation commenced on Lake Erie. The pioneer steamboat called "Walk-in-the-Water" was launched at Black Rock, May 28, 1818.

In the *Federal Gazette and Baltimore Daily Advertiser* of April 27, 1818, I find two advertisements of steamboats running to Philadelphia,—one, of the Union Line of Steamboats *via* Frenchtown and New Castle, advertised by William McDonald & Son to start from the lower end of Bowly's wharf every evening at five o'clock; the

[29] Charles H. Dow's History Steam Navigation between New York and Providence, 1792, 1877.

other, advertised by Briscoe & Partridge, leaving the same wharf at the same hour: "the passengers, traveling over a good turnpike road from Elkton to Wilmington, will then take steamboats, and arrive in Philadelphia in time for the boats which leave that place for New York."

1819.—The first steamers placed on the line between the Mersey and the Clyde were the "Robert Bruce" and the "United Kingdom," which began to ply regularly, in 1819, between Liverpool and Glasgow. The following is the advertisement of the first return voyage from Liverpool to Glasgow of this pioneer vessel:

"SAFE AND EXPEDITIOUS TRAVELING BETWEEN LIVERPOOL AND GLASGOW.

"The elegant new steam-packet 'Robert Bruce,' Captain John Paterson, will sail from Glasgow to-morrow (Tuesday), the 23d of August, at eight o'clock in the morning, from the George's Dock pier-head. The accommodation for passengers is most excellent, and she is expected to perform the passage within thirty hours. The fare in the cabin forty shillings, steerage twenty-one shillings; passengers *will be accommodated with provisions* at moderate terms. For passage apply to Captain Paterson, or to John Richardson.

"LIVERPOOL, 2d August, 1819."

The first steam-vessel employed in the Irish trade with Liverpool was the "Waterloo," built at Greenock, and launched on the 18th of June, 1819. After being fitted with engines and other requisites for a passenger steamer, she proceeded to Belfast, being intended to ply between that port and Glasgow. Her destination, however, was soon changed, and she was placed on the line between Liverpool and Belfast. Her first arrival was an affair of much consequence, and was thus announced in the *Liverpool Mercury* of July 23, 1819:

"Yesterday a beautiful steam-packet arrived at this port from Belfast, after a passage of only twenty-four hours. She is called the 'Waterloo,' and is a fine, well-built vessel, burden two hundred and one tons, length ninety-eight feet, breadth on deck thirty-seven feet, and has two highly-finished steam-engines of thirty horse-power each, which work without noise or vibration, and are on the low-pressure construction, perfectly safe from accident. They are attended by two experienced engineers. The vessel is provided with two masts, with sails and rigging. Her interior accommodations are as complete and elegant as skill and expense can make them. She has a handsome dining-room, capable of accommodating all the cabin passengers, a separate and neatly decorated cabin for ladies, and two apartments for private families; twenty-two well-furnished beds, each accommodated with light and air; and a comfortable place for steerage passengers. She cost nearly ten thousand pounds. She will sail for Belfast at tide time to-day, and will return on Monday. She will sail the same day, and regularly every Monday and Friday. Fares, cabin, £1 11*s.* 6*d.*; steerage, 10*s.* 6*d.* The cabin passengers *are not under the necessity of taking provisions*, as they are well accommodated on board with everything at the most moderate prices."

The "Waterloo" was soon transferred to the more important traffic between Liverpool and Dublin, where her success resulted in the employment of more powerful steamers.

This detailed account of so small a steamer may be pardoned when we consider that the "Waterloo" was the germ and pioneer of the magnificent steam fleet which now sails in and out of the port of Liverpool. It is no longer necessary to caution passengers they are not under the necessity of provisioning themselves.

1819.—*The Savannah, the first Ocean Steamer.* This vessel—pronounced a myth by Mr. Woodcroft in his work on "Steam Navigation," and regarding which the *London Illustrated Times* for January 16, 1858, says it "is forced into the belief was merely an after-thought of the Americans," and claiming that the "Rob Roy," a British steam packet between Glasgow and Belfast, was the first sea-going steamer—can be easily shown was no myth, but a *bonâ fide* sea-going steamer, and that by the aid of sails and steam she made the passage from New York to Liverpool in twenty-six days in 1819.

The "Savannah" was built at Corlear's Hook, New York, by Crocker & Fickett. She was three hundred and eighty tons burthen, and was launched on the 22d of August, 1818, and built to ply between New York and Liverpool as a sailing packet. About the time of her launch, Captain Moses Rogers, then of Savannah, Georgia, suggested to Messrs. Dunning, Scarborough, O. Sturges, B. Burroughs, J. P. Henry, Berna McKinna, and others of that city, the idea of constructing a steamer for plying between Savannah and Liverpool. They accordingly purchased this ship, just launched at Corlear's Hook, and well adapted for the purpose, and named her the "Savannah." They allowed the rigging and other appurtenances for sailing to remain, and supplied her with steam-machinery and *paddle-wheels*, the latter constructed to fold up like a fan and laid upon deck when not in use, her shaft having also a joint for that purpose. The wheel-house was made of canvas extended on an iron rim. She made a trial voyage to Savannah in April, 1819, and arrived there from New York in seven days, after a boisterous passage, during which she had several times to take in her wheels and rely upon her sails.

This trial trip left no doubt that the "Savannah" would successfully accomplish the object for which she was purchased, and she sailed from Savannah for Liverpool, May 26, 1819. The New York papers of the 2d of June notice her having been spoken at sea, all well. The log-book of the "Pluto," which arrived at Baltimore from Bremen, contains the following passage: "June 2, 1819.—Clear weather, smooth sea, latitude 42°, longitude 50°. Spoke and passed the elegant steamship eight days out from Savannah to Petersburg, by way of Liverpool. She passed us at the rate of *nine or ten knots*, and the captain informed us she worked remarkably well, and the greatest compliment

we could bestow was to give her three cheers, as the happiest effort of mechanical genius that ever appeared on the Western ocean."

Niles's *New York Register* for the 21st of August contains the following paragraph italicized at the head of its column of foreign news: "*The steamship 'Savannah,' Captain Moses Rogers, the first that ever crossed the Atlantic, arrived at Liverpool in twenty-five days from Savannah, all well, to the great astonishment of the people of that place. She worked her engine eighteen days.*"

It is stated that "on the 'Savannah's' approach to Liverpool with sails furled and American colors flying, the piers were thronged by thousands who greeted her arrival with the most vociferous cheers, and before she anchored her decks were so crowded that it was with the greatest difficulty the crew could move about in the performance of their duty."

The next record of her movements is that she sailed in August for St. Petersburg, passing Elsinore on the 13th, and that the British "wisely supposed her visit to be somehow connected with the ambitious views of the United States."

She returned to Savannah in November, 1819, after a passage of fifty-three days from St. Petersburg *via* Copenhagen and Arendal, in Norway, all well; in the language of Captain Rogers, "with neither a screw, or bolt, or rope-yarn parted, though she encountered a very heavy gale in the North Sea." She left Savannah for Washington on the 4th of November, and lost her boats and anchors off Cape Hatteras.

But for the war of 1812, the "Savannah" would have been anticipated in her ocean voyage by a larger and superior vessel, built by a company for the Russian government. This vessel, the "Emperor Alexander," was nearly ready for sea when her departure was prevented by the declaration of war in June, 1812. Under the name of the "Connecticut" she was known upon the waters of Long Island Sound, and later in her history was a weekly packet between Portland, Maine, and Boston, Massachusetts.

If these statements do not satisfy the most doubting that the "Savannah" was no myth or an after-thought of the Americans, the following extracts from a petition to Congress, in 1856, by Mrs. Taylor, the daughter of her constructor, fortified by the sworn testimony of Captain Rogers, must be conclusive.

Mrs. Taylor says, "Your petitioner is the only surviving child of the late William Scarborough, of Savannah, Georgia, who, being an energetic and enterprising man of great mechanical genius, caused to be constructed in the years 1818–19, with his own means, and those of every friend he could enlist in the effort, the first steamer that ever crossed the Atlantic, 'The Savannah,' of Savannah, Georgia, Captain Moses Rogers, of New London, Connecticut, commanding."

For the details of this voyage she refers to the following sworn

statement of Captain Stevens Rogers, the sailing-master, "and prays that they will grant her some pecuniary acknowledgment," etc.

Captain Stevens Rogers, under date New London, Connecticut, May 2, 1856, swears that he is aged sixty-eight years; that he was the *sailing-master* of the steamship "Savannah" on her trip to Liverpool, Copenhagen, St. Petersburg, etc. "Said steamship was built at the city of New York, in the year 1818, the builders being Fickett & Crocker. She was designed for a Havre packet, and was purchased by William Scarborough, of Savannah, and was named at his suggestion 'The Savannah,' he having told me that in his opinion the ocean would be navigated by steam, and he intended his own State and city should have the credit of sending the first steamer across the Atlantic. Her castings were made in New York, and her boilers at Elizabethtown, New Jersey, by Daniel Dodge. She left New York under canvas, and arrived at Savannah in the early part of May, 1819. President Monore was then in Charleston, South Carolina, and Mr. Scarborough directed us to go there and give the President an invitation to come to Savannah on the steamship. The President declined because the people of Charleston did not wish him to leave their State in a Georgia conveyance, but said that he would visit us at Savannah. So we returned. A few days after we got back the President arrived, and came on board the vessel with his suite and several naval officers and citizens. The vessel was navigated by steam, and we proceeded down the river on an excursion. The President dined on board, and expressed himself greatly pleased with the vessel, and told Mr. Scarborough that when she came back from her trip across the Atlantic, to bring the vessel around to Washington, for he thought there was no doubt the government would purchase her, and employ her as a cruiser upon the coast of Cuba.

"We sailed from Savannah for Liverpool on the 26th of May, 1819. Moses Rogers, my brother-in-law, was master and engineer. I was sailing-master, and Mr. Blackman was third officer. We made the port of Liverpool in twenty-two days after leaving Savannah, fourteen of the twenty-two under steam. The only reason why the whole voyage was not performed by steam was the fear of the fuel giving out. Off Cape Clear, the admiral at Cork dispatched a ship to our relief, supposing we were *on fire*. At Liverpool we caused a great deal of excitement, and some suspicion as having some design to release Napoleon from St. Helena. From Liverpool we proceeded to Copenhagen, and from thence to Stockholm. At both places she excited great curiosity; at the latter place she was visited by the royal family, Mr. Hughes (our minister), and Lord Lyndoch. Lord L. went with us to St. Petersburg. On the passage he desired us to bring the vessel from steam to canvas. He held his watch and noted the time, fifteen minutes. So delighted was he that he exclaimed, 'I blame no man

born in the United States for being proud of his country; and were I a young man I'd go there myself.' The Emperor of Russia came on board at Cronstadt, and was much pleased with the vessel, and presented Captain Rogers with two iron chairs (one of which is now in the garden of Mr. Dunning at Savannah)."

Captain Rogers then states that he has in his possession a gold snuff-box presented to him by Lord Lyndoch, upon which is the following inscription:

"Presented by Sir Thomas Gresham, Lord Lyndoch, to Stevens Rogers, sailing-master of the steamship 'Savannah,' at St. Petersburg, Oct. 10, 1819."

He adds: "We sailed from St. Petersburg to Arendal in Norway, and from thence to Savannah, in twenty-five days, steaming on the passage *nineteen days*. We went from Savannah to Washington at the suggestion of President Monroe, but the government did not buy her. She was there sold at auction and converted into a packet."

Captain Rogers concludes by saying that Scarborough ruined himself by her and died poor. While at St. Petersburg the "Savannah" was anchored opposite, and about six miles distant from the city. After being used for a time as a sailing-packet between New York and Savannah, the "Savannah" went ashore on Long Island and was broken up.[80]

[80] Captain Stevens Rogers, the sailing-master, died at New London, Connecticut, September, 1868, aged seventy-four years. The log-book of the "Savannah," containing the daily record of her memorable voyage, is in possession of his descendants.

This valuable relic is made up of ninety-six pages of coarse paper of unusual size, twelve inches wide and nineteen and a half long, browned with age, and with edges ragged from much handling. Only fifty-two pages are written on, the rest are blank. It is unbound, but the sheets are sewn into an enveloping piece of sail-cloth, which is rudely hemmed at the upper and lower edges. This cloth cover bears the inscription, "Steamship 'Savannah's' Log-Book," printed in bold characters. The handwriting is that of Stevens Rogers, the sailing-master. Every word in the closely-written pages is legible, the ink being still black; only a small portion of the entries have any present interest, the larger part being remarks on the weather, on the disposition of the ship's sails, and the results of the observations of latitude and longitude.

The caption of the first page is as follows:

"A Journal of a Voyage from New York towards Savannah on board steamship 'Savannah;' Moses Rogers, Master."

This is continued on four pages; the caption of the fifth is,—

"A Half-Hour Journal on board steamship 'Savannah,' Moses Rogers, Master."

And after a few pages this caption gives place to—

"A Journal of a Voyage from Savannah towards Liverpool on board steamship 'Savannah;' Moses Rogers, Master."

The caption afterwards changes several times, but the same formula is preserved.

The first entry in the log-book is—

"Sunday, March 28, 1819. These 24 hours begins with fresh breezes at N. W. At 10 A.M. got under way for Sea with the crew on board. At 1 P.M. the Pilot left the Ship off Sandy hook light."

After this entry the page is ruled on the left side into six narrow columns,

1819–22.—Great Britain owes to David Napier the establishment of deep-sea communications by steam-vessels, and of post-office steam packets, at about the same date as the adventurous voyage of the "Savannah." Previous to his enterprise steam-vessels rarely ventured,

headed respectively, "H, K, HK [hours, knots, half knots], Course, Winds, LW;" and then a longer space, headed, "Remarks on board," with the appropriate date.

The second entry is as follows:

"Remarks on board Monday, March 29, 1819. The 24 hours begins with fresh breezes and clear. At 4 P.M. the Highlands of Neversink bore N. b. W. 6 Leagues distant from which I take my departure. At 10 P.M. took in Topgallant Sails. At 6 A.M. Set Topgallant Sails. At 8 A.M. Tacked Ship to the Westward. Saw a brig and Schooner Steering to the Westward. At 11 A.M. took in the Mizzen and Fore Top gallant Sails. At 11 A.M. got the Steam up and it coming on to blow fresh we took the Wheels in on deck in 30 minute. At meridian fresh breezes and Cloudy. Lat. by Obs. 39° 19′."

This is a fair sample of the daily records, extending over a period of nine months.

The statement, "we took the wheels in on deck in thirty minute," refers to the fact that this steamer was so constructed that, in case of boisterous weather, her paddle-wheels could be brought on deck.

Land was sighted on June 16, being the coast of Ireland, and on the 17th the "Savannah" "was boarded by the King's Cutter 'Kite,' Lieutenant John Bowie."

The log-book here, as elsewhere, is sternly brief. Fortunately we have in Stevens Rogers's own words a fuller account of the amusing circumstances connected with this boarding of the "Savannah" by the king's cutter. In a communication to the New London (Conn.) *Gazette*, he said, "She [the steamer] was seen from the telegraph-station at Cape Clear, on the southern coast of Ireland, and reported as a ship on fire. The admiral, who lay in the Cove of Cork, dispatched one of the king's cutters to her relief. But great was their wonder at their inability, with all sail in a fast vessel, to come up with a ship under bare poles. After several shots were fired from the cutter, the engine was stopped, and the surprise of her crew at the mistake they had made, as well as their curiosity to see the singular Yankee craft, can be easily imagined. They asked permission to go on board, and were much gratified by the inspection of this naval novelty."

Two days later (June 20) they "shipped the wheels, furled the sails, and ran into the River Mersey, and at 6 P.M. come to anchor off Liverpool with the small bower anchor."

The London *Times* of June 21, 1819, has the following paragraph, credited to *Marwade's Commercial Report* for that week:

"Among the arrivals yesterday at this port we were particularly gratified and astonished by the novel sight of a fine steamship, which came round at 7½ P.M. without the assistance of a single sheet, in a style which displayed the power and advantage of the application of steam to vessels of the largest size, being *three hundred and fifty tons* burden. She is called the 'Savannah,' Captain Rogers, and sailed from Savannah (Georgia, United States) the 26th of May, and arrived in the Channel five days since. During her passage she worked the engine eighteen days. Her model is beautiful, and the accommodations for passengers elegant and complete. She is THE FIRST SHIP on this construction that has undertaken *a voyage across the Atlantic.*"

The *Times* of June 30, 1819, says, "The 'Savannah' steam vessel recently arrived at Liverpool *from America*—the *first vessel* of the kind that *ever crossed the Atlantic*—WAS CHASED A WHOLE DAY off the coast of Ireland by the 'Kite' revenue cruiser, on the Cork Station, which mistook her for a ship on fire."

Lloyd's List reports the arrival of the "Savannah" at Liverpool on the 20th of June, 1819, bound to St. Petersburg; and in *Gore's Annals of Liverpool* this American steamer's arrival is recorded among "remarkable events."

and only in fine weather, beyond the precincts of rivers and the coasts of firths. Soon after the introduction of steam on the river Clyde he entertained the idea of establishing steam communication on the open sea, and as a first step endeavored to ascertain the difficulties to be encountered. For this purpose he took a passage, at a stormy period of the year, on a sailing packet which then formed one of a line and the only means of intercourse between Glasgow and Belfast, a passage which required a week to accomplish what is now done by steam in nine hours. The captain of the packet found a young man, whom he afterwards knew as Mr. Napier, during one of his winter passages to Belfast, constantly perched on the bow of the vessel, fixing an intent gaze on the sea when it broke on the side of the ship, quite heedless of the waves and spray that washed over him. He only ceased from this occupation at intervals as the breeze freshened to ask the captain whether the sea was such as might be considered a rough one, and, when told that it was by no means unusually rough, he returned to the bow of the vessel and resumed his study of the waves breaking at her stem. When the breeze began to freshen into a gale, and the sea to rise considerably, he again inquired of the captain whether the sea might now be considered a rough one, and was told that as yet it could not be called very rough. Disappointed, he returned again to his station at the bow and resumed his employment. At last he was favored with a storm to his contentment; and when the seas, breaking over the vessel, swept her from stem to stern, he found his way back to the captain and repeated his inquiry: "Do you call it rough now?" When the captain said that he could not remember to have faced a worse night in the whole of his experience, young Napier appeared delighted, and muttering as he turned away, "I think I can manage if that be all," went down to his cabin. Napier saw then the end of his difficulties, and soon satisfied himself as to the means of overcoming them.

His next inquiry regarded the means of getting through the water with least resistance. To determine this, he commenced a series of experiments with models of vessels in a small tank of water, and soon found that the round full bluff bow adopted for sailing vessels was quite unsuited for speed with mechanical propulsion of a different nature. This soon led him to adopt the fine, wedge-like entrance by which the vessels built under his superintendence were afterwards so distinguished.

In 1818 he established a regular steam communication between Greenock and Belfast by means of the "Rob Roy," a vessel of about ninety tons burden and thirty horse-power. She plied two winters between those ports with regularity and success, and afterwards was transferred to the English Channel as a packet between Dover and Calais. Having thus acquired steam navigation dominion of the open sea, Mr. Napier was not slow to extend it.

In 1819 the Messrs. Wood built for him the "Talbot," of one

hundred and fifty tons, with two of Mr. Napier's engines, each of thirty horse-power, the most perfect vessel of her day in all respects, and a model which was long in being surpassed. The "Talbot" plied between Holyhead and Dublin, and conferred on Ireland the advantage of a direct, certain, and rapid communication with England.

In 1822, Napier introduced successfully surface condensers on board the "Post Boy," a steam-vessel built by him. The condenser consisted of a series of small copper tubes, through which steam passed towards the air-pump. By a constant current of cold water encircling the pipes the steam was cooled, and returned into water, which was again returned into the boiler for conversion into steam, without being mixed with the cold salt water, which in the ordinary plan was injected into the condenser. The rapidity of condensation was found insufficient, and he returned to the old system for condensation. Years afterward he returned to this system, in circumstances which rendered it desirable, and, using flat plates instead of tubes, was more successful, and plied for years with no other condenser.

1819.—The first steamboats to ascend the Missouri were three little government boats in 1819. A party of engineers and naturalists kept along near them on shore. The Pawnees pilfered the horses, provisions, and apparatus of the unfortunate *savans*, and left them to wander, hungry and half naked, till they found refuge among the friendly Kaws. These steamers stemmed the current with difficulty, and were delayed by sand bars; for this was before steamboats were educated up to walking off on their spars as a boy walks on his stilts; and on their return they dropped down river stern foremost, as they were more manageable in that position. One of the first boats to ascend the Missouri carried the figure-head of a serpent at her prow. Through this reptile's mouth steam escaped, and the savages when they saw it fled in alarm, fancying the spirit of evil was coming bodily to devour them.

In 1819 a vessel of seven hundred tons, named the "Robert Fulton," and ship-rigged, but furnished with a steam-engine, was built at New York, to ply as a packet between New York, Charleston, Cuba, and New Orleans. She performed her voyage over that long route with great regularity in nine days, and was running on it in 1822. So far as safety and speed were concerned, she was successful; but she did not defray expenses, and the vessel was sold to the Brazilian government and her engine removed, and she was converted into a cruiser. In 1838 she was in the Brazilian service.

The "Walk-in-the-Water," the only steamboat on Lake Erie in 1819, was considered sufficient to transact the commercial business of that lake. This boat, named after the Wyandotte chief, made her first trip to the island of Mackinaw in the summer of 1819. There was no one to furnish her with a cargo except the American Fur Company.

In 1827 the waters of Lake Michigan were first plowed by steam,

a boat having made an excursion to Green Bay; and in 1832 another steamboat reached Chicago with troops, that site being in course of clearance and settlement. In 1840 forty-eight boats were trading between Buffalo, Chicago, and other ports west of Detroit, the trip occupying fifteen days.

In 1820 the first steam-vessel was prepared for Ramsgate, and was called the "Eagle." She had two of Bolton & Watt's engines, equal to forty horse-power. In 1850 she was still in existence, and used by the King of Denmark as his steam-yacht. If a sailing packet prior to the advent of steam conveyed to or from London and Ramsgate eight hundred passengers a month it was something extraordinary. Yet in November, 1850, the "City of London," steam-packet, conveyed five thousand three hundred and fifty-six persons.

1820–23.—The "Comet," "Lightning," and "Meteor" were the first steam-vessels that ever appeared in the British navy, and the "Comet" was the first that ever carried a pennant.

These sister-vessels were constructed by Oliver Lang, then an assistant-surveyor of the navy, in the year 1820, *the three surveyors in office having refused to take the responsibility of constructing a steam-vessel for sea service!* These three vessels were built at Deptford, in about three years, from Mr. Lang's drawings and plans of fittings, without the interference of any one, and solely under his own direction and personal superintendence.

The following was the Admiralty return of their dimensions to the House of Commons, made in answer to the inquiry of Rear-Admiral Sir Charles Napier, in 1846:

Name.	Guns.	Length.	Breadth.	Depth.	Class.	Horse-power.	Engine.
		feet.	*ft.* *in.*	*ft.* *in.*			
Comet	3	115	21 3	11 11	Paddle.	80	Bolton & Watt's Side Lever.
Lightning	3	126	22 8	13 8	"	100	"
Meteor	3	126	22 8	13 8	"	100	"

The first *iron* steamboat ever built was constructed in 1820 at the Horsley Iron Works. She was called the "Aaron Manby," after her projector. She was built in sections and put together at London, and was the first vessel that ever went direct from London to Paris.

In 1820 there was only *one* small steamboat on Lake Erie. In 1831, *eleven* steamboats, with an aggregate capacity of two thousand two hundred and sixty tons. In 1836, forty-five steamboats, of nine thousand one hundred and nineteen tons. In 1847, sixty-seven side-wheel steamers and twenty-six screw steamers.

In 1822, Messrs. Wood built on the Clyde the "James Watt," to ply between Leith and London. She measured four hundred and forty-eight tons and carried two engines of fifty horse-power each,

made by Bolton & Watt, under the superintendence of Mr. Brown, one of the firm. The "James Watt" was remarkable for having its paddles moved through the interposition of toothed wheels, and not directly by the engine; so that the revolution of the axis of the engine was greater than that of the paddles. With the exception of the low proportion of power to tonnage, the "James Watt" possessed nearly all the qualities of the most improved vessels of a quarter of a century later.

1820.—A small steamboat christened the "Snake" was built in Bombay in 1820, and was the first steam-vessel on the Indus, and, in fact, on any river in India. Her engines were designed and built by a Parsee, and were the first ever manufactured in India. How well they were constructed is evidenced by their lasting powers. She was twice wrecked,—once in a hurricane in 1837, and again in a cyclone in 1854. She was employed during the first British Burmese war and on the expedition to the Persian Gulf from 1823 to 1826, in the Chinese war of 1841–42, Burmese war of 1852, Persian war of 1856, mutiny of 1857, Chinese expedition of 1859, etc., etc. She in her day carried most of the notables that arrived in India *via* Bombay, and closed her eventful career of sixty years in 1880, when she was broken up.

A steamboat was launched at Potsdam in 1820, larger than any yet built in Europe. It was two hundred feet long and forty-four feet wide, had two engines of twenty horse-power each, and was named "The Blucher" with grand ceremony.[21]

1821.—The first sea-going steamboat sent out from Hull, England, was in 1821, and is reputed to be the first sea-going steamboat on the east coast of England. In 1854 the sea-going steamers connected with Hull had an aggregate tonnage of 9139, and the river-boats 2218 tons; other steamboats coming to and departing from Hull had a burthen of 5909 tons; altogether there were eighty steamers trading with Hull, fifteen of which were screws.

THE FIRST STEAMBOAT EXCURSION FROM NEW YORK TO NEWPORT AND PROVIDENCE.

In 1821 there was an excursion from New York to Providence in the steamboat "Robert Fulton." The *Manufacturers' and Farmers' Journal* of August 27, 1821, contains the following concise notice of the event:

"The 'Robert Fulton' left New York Thursday afternoon at five o'clock, and arrived below at nine Saturday morning. As soon as the tide would permit she came up to town, where she was the admiration of crowds of visitors. She brought eighty passengers, among whom was the Hon. John Quincy Adams, Secretary of State, who immediately proceeded to Boston by land. At about two o'clock the 'Fulton' departed on her return to New York."

[21] *Literary Gazette*, February, 1820.

The journal of one of the passengers supplies further particulars of this interesting trip. He says,—

"On Friday, at a quarter before eight P.M., we ranged alongside of the dock at Newport, music playing as we entered the harbor and passed the fortified island. Such a scene of tumult as was here witnessed I never saw before. The wharves were lined with people of all ages and conditions, who pressed forward and immediately on our landing took complete possession of the ship. The band and many of the passengers went on shore, and Governor Gibbs and some of the principal families in town were serenaded. When the party returned to the ship they were scarcely able to get on board, and the tumult lasted until one o'clock in the morning.

"We started at 5 A.M. next day for Providence. As we approached the scene became truly interesting. The inhabitants had anticipated our arrival, and every hill was covered with an admiring assemblage. India Point wharf presented a spectacle singular and gratifying. The beauty and fashion of this charming town greeted us with cheers and welcoming. At 7.45 we came up to the dock and landed the company, and here again numerous parties of ladies and gentlemen crowded the ship. The masts and rigging of the vessels lying in the vicinity were covered with spectators, and nothing could exceed the interest and gratification with which all appeared to greet our arrival. At 3 P.M. the 'Fulton' left the wharf amid the shouts of thousands.

"We arrived at Bristol at half-past 5 P.M., where we were met with the same spirit of enthusiasm which had characterized our whole route. Mr. De Wolfe's elegant mansion was thrown open to the visits of the passengers, and was much admired. We arrived at Newport at 8 P.M. It was quite dark, but the interest appeared to have increased rather than diminished. I took a station at the gangway to assist the inhabitants, and particularly the ladies, on board the ship,—notice having been given that none but ladies would be allowed on board at first,—and in the short space of twenty minutes I handed in three hundred and thirty-seven. I found that this number did not appear to have thinned the crowd in the least degree, and by nine o'clock there must have been on board upward of six hundred ladies."

FIRST LINE OF STEAMBOATS BETWEEN PROVIDENCE AND NEW YORK.

The "Fulton" steamed away, and no more steamboats came from Providence here until the 6th of June, 1822, when the "Connecticut," Captain Bunker, arrived from New York.

The New York Legislature had granted great privileges to the Livingston and Fulton Steam Navigation Company. No steam vessel could navigate New York Bay, the North River, Long Island Sound, or any of the lakes and rivers of the State of New York, without their

license. The Connecticut Legislature thereupon enacted that no vessel bearing such a license should enter any waters within that State. The "Connecticut" was running at this time between New York and New Haven in opposition to the packet lines, and it was through the influence of the packet-owners that the Legislature of Connecticut passed its prohibitory law. The "Fulton" and the "Connecticut," running between New York and New London, were thus driven from Connecticut ports.

The *Providence Journal*, June 3, 1822, quoting from the New York *Mercantile Advertiser* the announcement that steam communication between New York and New Haven had ceased, states that the "Fulton" and "Connecticut" had sailed for some point in Rhode Island. June 6, the arrival of the "Connecticut" for the first time was announced in the "marine news," and July 12 the "Fulton," Captain Law, arrived at Providence from Pawcatuck.

The "Rhode Island and New York Steamboat Company" was organized the same day, and the "Connecticut," Captain Elihu S. Bunker, and "Fulton," Captain Richard Law, began their regular trips between Providence and New York, touching at Newport. The fare between Providence and New York was ten dollars, and between Newport and New York nine dollars. The first advertisement of this company appears under the cut of a man-of-war with port-holes open and every sail set. In a few weeks, however, a steamboat cut was procured, and then the advertisement announced that

"*From New York* a boat will depart on Wednesday and Saturday at 4 o'clock P.M., and

"*From Providence* a boat will depart on Wednesday and Saturday at 6 o'clock A.M."

The "Fulton" and "Connecticut" continued to make weekly trips through the season, and thus began the steamboat trade between Providence and New York. The log of the first trip of the "Connecticut" is in substance as follows: Left New York on the 4th at 4 P.M.; was detained at Sandy Point 8½ hours by easterly winds; on the 5th continued our voyage, and arrived off Fisher's Island at 8 P.M. Lay to 3 hours; doubled Point Judith at 2 A.M.; touched at Newport, and arrived at Providence at 8 A.M. on the morning of the 6th of June.

During the autumn of 1822 the amount of travel and rate of speed (the time being between New York and Newport) were, September 13, "Fulton," 27 hours from New York, 40 passengers; October 4, "Connecticut," 32 hours, 40 passengers; October 6, "Fulton," 24 hours, 26 passengers; October 10, "Connecticut," 18 hours, 35 passengers.

The "Fulton" withdrew November 16 for the winter, and the "Connecticut" was continued on the line, making one trip per week

until the navigation was closed by the ice. The following announcement reads queerly enough now:

"The 'Connecticut' will leave Providence every Tuesday evening to go down the river, in order to start from Newport at an early hour Wednesday morning. *It will therefore be necessary for the passengers to be on board at Providence at ten in the evening.*"

APPEARANCE OF THE BOATS.

The "Connecticut" and "Fulton" were owned in New York. The former was one hundred and fifty feet long, twenty-six feet wide, and about two hundred tons burden. Her color was white, with green trimmings. She had a square engine, and cost about eighty thousand dollars. The "Fulton" is said to have been the first steamboat built expressly to navigate Long Island Sound. She was enormously strong, and had a little less machinery than is now put in a cotton-mill. Her wheels were turned through the medium of a cog-wheel with teeth about five inches long. She made a terrific noise when in motion, but, with all her internal commotion, moved so slowly that once she was five hours going from Providence to Newport. Her color was black, and she carried sails to help the steam. Her captain once told with great glee that he had come all the way from New York without hoisting his sails.

Neither boat had upper saloon, state-rooms, or hurricane-deck. Both boats burned pine wood under large *copper* boilers, which were kept polished to the last degree of brightness. An enormous quantity of wood was necessary to keep steam up during the trip between Providence and New York. It was piled everywhere, fore and aft, and high above the guards. But little freight was carried, the wood taking up all available room. When coal was introduced, years afterwards, iron boilers were substituted, and the old copper boilers paid for the new iron ones.

In the spring of 1823 the "Connecticut" and "Fulton" resumed their trips. The "Fulton" had been overhauled and her speed improved, so that she was nearly as fast a boat as the "Connecticut." She made her first trip to Providence in 1823, on the 12th of May. Captain William Comstock was in command, and she brought fifty passengers. When near Field's Point, one of her boilers was discovered to be "partially ruptured." The fires were at once hauled and the boat anchored all night. In the morning she was taken to Providence, and five days afterwards was again on the line.

Scarcely was the line again in operation when the packetmen caused to be introduced in the General Assembly of Rhode Island two bills, one a Prohibitory Bill, which restricted the landing of steamboat passengers on Rhode Island soil, the other a tax bill imposing a tax of fifty cents upon each passenger by steamboat. The tax bill passed the Senate, but was rejected by the House, the proposed measure being

decided unconstitutional. Consideration of the other bill seems to have been indefinitely postponed.

During the season of 1823 the "Connecticut" and "Fulton" made regular trips between Providence and New York, leaving Providence Wednesdays and Saturdays at 6 A.M., and New York Wednesdays and Saturdays at 4 P.M. The advertisement which announces this programme concludes with the singular remark: "Travelers are requested to read the above notice right."

As the "Connecticut" approached Nayatt Point one bright June morning of 1823, a commotion was observed on shore, and two skiffs seemed to be making for the steamer. The occupants seemed to be making signals for the vessel to stop, and so much interest was aroused that Captain Bunker steered towards the foremost skiff and hailed the occupants. There was no answer, but from the boat in the rear came oaths and shouts from which the company on the steamer easily gathered that the occupants of the foremost boat were a runaway couple in pursuit of some Gretna Green. As their boat came within a dozen yards of the steamer the young man looked up and said, "Will you take us on board, sir?" There was an enthusiastic response from the passengers, and a score of hands lent aid. Captain Bunker seemed entirely unconscious of what was going on, but tradition has it that the instant the young man's feet touched the deck of the steamer the engineer received the order to "go ahead" with a suddenness that nearly took away his breath; and in a very few seconds a wide stretch of foaming water lay between the steamer and the empty boat.

NOTE.—The following table exhibits the average and comparative length of the voyages of steam and sailing vessels between British ports and those of surrounding seas, as reported to the British Parliament in June, 1822:

Ports.	Steam-vessels. Hours.	Sailing-vessels.	Distance. Miles.	Ports.	Steam-vessels. Hours.	Sailing-vessels.	Distance. Miles.
Holyhead to Dublin	8	70 hours	55	Brighton to Dieppe	9	30 hours	73
Port Patrick to Donaghadee	3	8 "	19½	Southampton to Havre	15	36 "	120
London to Leith	55	5 days	429	" " Guernsey	16	37 "	125
" " Dublin	84	16 "	610	Milford to Waterford	11	25 "	81
Dublin to Liverpool	14	36 hours	131	Greenock to Belfast	13	30 "	90
Greenock to Liverpool	24	13 days	224	" " Glasgow, up	3	12 "	24
London Bridge to Calais	12	36 hours	120	" " " down.	2½	6 "	
London to Margate	8	20 "	84	" " Dublin	25	52 "	200
" " Plymouth	38	10 days	315	" " Ayr	6	12 "	48
" " Belfast	110	18 "	725	" " Largo	2	4 "	18
" " Ostend	12	24 hours	90	" " Port Patrick	9	20 "	90
" " Texel	22	54 "	170	" " Isle of Man	18	40 "	135
" " Scarborough	25	68 "	225	" " Campbeltown	16	18 "	67
" " Portsmouth	29	8 days	255	Edinburgh to Aberdeen	12	25 "	90
" " Hull	23	50 hours	215	" " Sterling	4	8 "	36

1823.—In 1823 there were about three hundred steamboats in American waters. The same year there were public rejoicings at Louisville, Kentucky, when a steamboat arrived there in fifteen days and six hours from New Orleans. The captain, answering a complimentary

coast, gravely stated the upward passage might possibly be accomplished in *fifteen days!* Within twenty years the passage was actually performed in a few hours over *four days!*

Captain Henry M. Shreve, who commanded the first steamboat that ascended the Mississippi, and who invented the steam snag-boat, died March 6, 1851.

Between 1813 and 1823 one hundred and sixty steam-vessels were launched in England, varying all the way from nine to five hundred and ten tons in size, and from three horse-power to one hundred and twenty. The largest of these, the "Soho," was of smaller dimensions than the American steamboat "Chancellor Livingston," of five hundred and twenty tons, plying on the Hudson River between New York and Albany, and she was surpassed by the "Lady Sherbrooke," of seven hundred and eighty-seven tons, the largest then plying upon the St. Lawrence.

The "Chancellor Livingston" was constructed under the superintendence of Fulton. She was finally employed on the route between Portland, Maine, and Boston, Massachusetts. When her hull was worn out it was broken up, and her engine placed in a new boat built at Portland, and named the "Portland," which continued on the same service until the Mexican war, when she was used to convey United States troops to Vera Cruz, and at the close of the war sold, and wrecked on the coast of Texas. The "Chancellor Livingston's" keel was 154 feet long; deck, 165 and 32 broad; draught of water, 7 feet 3 inches; principal cabin, 54 feet long; ladies' cabin above the other, 36 feet long with closets; forward cabin, 30 feet long, 7 feet high. Permanent sleeping berths in principal cabin, 38; in ladies' cabin, 24; in fore-cabin, 56; in captain's cabin on deck, 8; engineers and pilots, 3; forecastle, 6; firemen, cooks, etc., 6. Total, 141.

Her engine was of 75 horse-power; diameter of cylinder, 40 inches; length, 5 feet; piston-rod, 8½ feet; stroke, 5 feet; boiler, 28 feet long, 12 feet broad, with 2 funnels; paddle-wheels, 17 feet diameter; paddle-board, 5 feet 10 inches long, with 2 fly-wheels each 14 feet diameter, connected by pinions to the crank-wheel. The machinery rose 4 feet above the deck. Her average speed was 8½ to 8¾ miles per hour. With a strong wind and tide in her favor, she made 12. The same against her, not more than 6.

July, 1823, "The Patent," a steamboat of about one hundred tons, owned and commanded by Captain Seward Porter, arrived at Portland. She was the first steamboat ever brought into Maine, and was bought in New York to run between Portland and Boston. Captain Porter had, in 1822, placed an old engine in a flat-bottomed boat, which he ran to North Yarmouth and the islands in Casco Bay. This he named "Kennebec," but the people called it the "Horned Hog."[32]

[32] Varney's "History of Maine."

1825.—The steamship "Enterprise" made the passage from London to Calcutta, and inaugurated the communication of England with India by steam.[33]

February, 1825, Jacob Perkins applied a propeller eight feet in diameter at the side of the rudder of a canal boat. It was built like a double set of windmill vanes, the solid axle of one set working the hollow axle of the other, and rotating in opposite directions.

A vessel was also built at Rochester the same year by the Canal Towing Company, fitted, on the plan of Samuel Brown, with a gas vacuum engine of twelve horse-power, working by means of beveled gear a *two*-bladed propeller at the bow. The blades were at an angle of ninety degrees to each other, and forty-five degrees to the axis.

Another vessel, with similar engine and propeller, was soon after tried on the Thames, and attained a speed of seven miles per hour.

1826.—A comparison of the following hand-bill with others of the present time will show the improvement that has been made in the North River boats during the past half-century:

HUDSON RIVER STEAMBOAT LINE.

CONSTITUTION, Captain W. J. Wiswell. — CONSTELLATION, Captain R. G. Crittenden.

DAILY.

These new and splendid Boats will be dispatched DAILY from New York and Albany, during the Summer months, commencing their regular trips, under this arrangement, on Monday, the 5th June: Leaving the wharf, foot of Cortland Street, New York, at 10 A.M., and the wharf, near the steamboat office, South Market Street, Albany, at 9 o'clock.

When practicable, the Boats will come to at the wharves at Newburgh, Poughkeepsie, Catskill, and Hudson. At Rhinebeck and Kingston, a convenient barge will constantly be in readiness to receive and land passengers.

At the other intermediate places passengers will be received and landed whenever it can be effected with safety.

These Boats are of the first class, and for extensive and airy accommodations, speed, and quiet motion of engines, and skillful management, are not surpassed by any boats navigating the Hudson River, and the proprietors assure the public that the most assiduous attention will be paid to the safety and comfort of passengers.

Agents for this line:

A. N. HOFFMAN, No. 71 Dey Street, New York.
A. BARTHOLOMEW, South Market Street, Albany.

☞ All freight and baggage at the risk of owners. Freight of light articles, one shilling per cubic foot.

May 23d, 1826.

[33] The "Enterprise" was a vessel of 470 tons burthen, having engines of 120 horse-power. She was commanded by Lieutenant Johnson, R.N., sailed from Falmouth, August 16, 1825, and arrived in Diamond Harbor, Bengal, on the 7th of December, having achieved a distance of 18,700 miles in 113 days, of which she was 64 days under steam, 39 under sail, and 10 at anchor. The "Enterprise" was built by an association of gentlemen, and was sold to the government of Bengal for £40,000, which, together with the passage-money, nearly paid her first cost. She was employed in the Burmese war with advantage, and on the occasion of the treaty of Malown saved the government six lacs of rupees by reaching Calcutta in sufficient time to prevent the march of troops from the upper provinces.

1826.—November 18, 1826, Bennett Woodcroft patented a screw propeller in England.

1827.—The following advertisement of a steamboat winter line between Philadelphia and New York is from a Philadelphia newspaper dated February 8, 1827:

STEAMBOAT WINTER LINE FOR NEW YORK,

And the only one now running between the two Cities. Through in one day. Two Citizens' Line Coaches leaves their office, No. 32 north Third street, nearly opposite the City Hotel, every morning (Sundays excepted) at 4 o'clock, breakfast at Vencleu's City Hotel, Trenton, dine on board the steamboat, under way from Perth Amboy, and arrive in New York early the same afternoon. Fare through $6.

For seats, apply at the above Office, Citizens' Line office, No. 23 south Third street, sign of Robinson Crusoe, and at the office of the Reading and Bethlehem Mail Stages, A. M'Calla's, White Swan, Race street.

☞ All baggage at its owner's risque.

1828.—The steamship "Atlas" was launched at Rotterdam in the summer of 1828. She had three engines of one hundred horse-power each, and four masts. Her decks were thirty-five feet longer than a first-rate man-of-war, and she was described as "a gigantic steam-vessel, the largest ever built."

The first steamer ever seen in Turkey, the "Swift," arrived at Stamboul during May, 1828. This solitary boat was purchased by an American and two or three others for three hundred and fifty thousand piasters, and was presented by them to Sultan Mahmoud.

1828.—*The "Curaçoa."*—It seems highly probable that the sight of the "Caledonia," which James Watts, Jr., brought early in 1817 from the Clyde to take up the Rhine, staying a little while at Rotterdam, had considerable effect in stimulating the interest of the Dutch in steam navigation; at any rate, they soon after ordered several small steamers from Scotland, and in 1827 a number of the merchants of Amsterdam and Rotterdam united for the hazardous experiment of running steamships between the Netherlands and the West Indies. Accordingly, they had a steamer built on the Clyde, which they named the "Curaçoa," of three hundred and fifty tons and one hundred horse-power, and dispatched her, in the summer of 1829, from Amsterdam to the Dutch West Indies. Another account says she started from Antwerp on her first trip August 12, 1828. The voyage to Curaçoa and from Antwerp was repeated several times with great commercial success; nevertheless, the enterprise soon came to an end.

December 10, 1828, Charles Commerow patented a perfect one-turn screw propeller or spiral, fixed parallel to the keel, being the outer bearing held by a second sternpost, behind which was the rudder.

1829.—November 29, 1829, Benjamin Smith, of Rochester, New York, obtained a patent "for propelling boats on the water by the application of sculling wheels, or a screw propelling wheel, formed

like the wheel of a smoke-jack, and fixed at the *stem* or bow of the boat by means of a shaft running through the centre, and worked by any suitable power." July 10, 1830, a Mr. Doolittle being at Syracuse, saw a steamer with wheels of this description arrive on the canal from the West.

1830.—February 4, 1830, John M. Patten, of Milton, Pennsylvania, patented "a spiral or screw-wheel" (described by him as an old invention).

May 22, Josiah Coply, of Warner Mark, Pennsylvania, patented "a shaft having affixed to it eight or any other number of vanes or fans, forming segments of spirals. These to be placed under water, parallel with the keel, and a rapid rotatory motion to be given to them."

October 1, Felix Peltier, of New York, patented "a screw placed in a horizontal position, and wholly uncovered or naked, whether formed of a single spiral wound round a solid arbor and cutting at constantly equal angles, or whether its inclination vary, and whether the spiral be of one or the same breadth throughout, measured from the arbor."

1830.—The first attempts to navigate the Danube by steam were made by French and German engineers, who were so confident of success that they did not even try the vessel, but at once, before trial, invited the Emperor Francis I. to honor them with his presence on their first trip to Pesth. His Majesty embarked, and a favorable passage was made *down* the stream. On arriving at Pesth with the Emperor on board the vessel created no little sensation; salutes were fired from the batteries, and the curiosity was intense; and to celebrate the great event public balls and other festivities were given. At the end of all these joyous proceedings His Majesty intimated his intention of returning to Vienna. But when orders were given to "go on with all speed" it was found the engines had insufficient power, and that the stream was carrying the boat *down* the river. All attempts to propel the boat against the current proving inefficient, His Imperial Majesty was obliged to land and proceed to Vienna through a country where the roads were so bad that the carriage frequently stuck fast in the mud.

In 1830, Mr. J. Pritchard, an Englishman, succeeded in conquering the Danube, and, passing the rapids of Floresdorf in his steamer, returned to Vienna, where his vessel was visited by the imperial family and permission given to name her the "Francis the First." A concession was granted to Mr. Pritchard by the Austrian government for the exclusive right of carrying on steam navigation on the Danube for fifteen years.

The first English steam ship-of-war to carry foreign mails was the "Meteor." The *United Service Journal* for 1830 says, "It has long been contemplated for the conveyance of the foreign mails. H. M. steam-vessel 'Meteor,' Lieutenant William H. Symons, is to proceed to the Mediterranean on this service. The first adoption of steam in

the conveyance of the foreign post-office mail has taken place. H. M. steam-vessel 'Meteor,' Lieutenant William H. Symons, left Falmouth February 5th for the Mediterranean. We look on this as an era in steam navigation which bids fair to introduce its more general adoption for the purposes of government."

The Hon. East India Company's armed steamer "Hugh Lindsay," Captain Wilson, of four hundred and eleven tons burden, and two engines of eighty horse-power each, arrived at Suez, April 20, 1830, from Bombay. She was the first steam-vessel that ever navigated the Red Sea. It had been for some time a favorite object of Sir John Malcolm, the governor of Bombay, to establish a steam conveyance for dispatches between that place and England, and the "Hugh Lindsay" was built for the purpose at a cost of forty thousand pounds; yet the blunder was committed of her not having capacity to carry more than six days' coal. In consequence the "Hugh Lindsay" was thirty-three days in reaching Suez from Bombay, having lost twelve days in the ports of Aden, Mocha, Jiddah, and Cosseir, coaling.

The letters sent by her reached England in less time than any ever received before from India. Colonel Campbell was the only passenger by her, from want of room, as the cabin and every other available place was occupied by coal. She was so deep in the water on leaving Bombay that she was *à fleur d'eau*, and her wheels could hardly revolve. The distances between the several places on her route are as follows: From Bombay to Aden, 1710 miles; from Aden to Mocha, 146 miles; from Mocha to Juddah, 556 miles; from Juddah to Cosseir, 430 miles; from Cosseir to Suez, 261 miles, which at twenty days' navigation is 155 miles a day, or six miles and a fraction per hour.

The following letter from the captain of the "Hugh Lindsay," which details this vessel's first attempt to establish a steam conveyance upon that sea where the Lord opened a path for the Israelites of old and Pharaoh and all his host so miserably perished is interesting:

"HON. COMPANY'S ARMED STEAMER 'HUGH LINDSAY,'
"SUEZ, April 22, 1830.

"SIR,—I have much pleasure in acquainting you with the arrival of the 'Hugh Lindsay' at Suez this day from Bombay, which place she left 20th of March. The passage has occupied more time than was expected, owing to the delay occasioned by receiving coal at Aden and Juddah. At the former place we were detained *six* days, and at Juddah five. We also touched at Mocha, which detained us a day. The present trip being an experiment, I was instructed, if time permitted, to visit you at Alexandria, for the purpose of communicating with you on the subject of steam navigation in the Red Sea; but, the season being now so far advanced, it is necessary we should use the utmost dispatch to insure our return to Bombay previous to the setting in of the south-west monsoon, for which reason we shall leave Suez as soon as we have

received what coal there is. We touched at Cosseir to take what fuel is there also, and we are apprehensive we shall find scarcely enough on the Red Sea to take us to Bombay.

"The 'Hugh Lindsay' is four hundred and eleven tons burden, and has two eighty horse-power engines. By the builders' plan, she appears to have been intended to carry about six days' coal; but in order to make the passage from Bombay to Aden she was laden as deep as could be, and left with her transom in the water. Notwithstanding on our arrival at Aden, after a passage of eleven days, we had only about six hours' coal remaining, which circumstance alone shows her unfit for the performance of the passage. Her being so deep, too, materially affected her speed. I met with greater detention in getting off coal at Aden and Juddah than I had anticipated. Arrangements might be made to expedite the shipment of coal at those places, but I am now of opinion the fewer depots the better, and that if steamers were built of a class that would be propelled by engines whose consumption of coal would not exceed nine tons in the twenty-four hours, and which should carry conveniently fifteen days' coal at that rate of consumption, then the navigation of the Red Sea would be best carried on in two stages, one from Bombay to Aden, and from thence to Cosseir or Suez direct. I think, too, there is no necessity for proceeding up as far as Suez, as every object might be equally well attained by going to Cosseir only. As far as the passengers are concerned, the majority, I should suppose, would prefer being landed at that place, for the purpose of viewing the antiquities on the route from thence to Alexandria, and the arrival of dispatches would be very little delayed when we take into account the time occupied by a steamer on going from the parallel of Cosseir to Suez, which, when northwest winds prevail, could not be done in less than two days and a half.

"I inclose a copy of the log of the 'Hugh Lindsay' from Bombay to Suez, conceiving it might possess some interest as the journal of the first steam-vessel which has ever navigated the Red Sea.

"I am, sir, etc."

1831.—April 23, 1831, Giraud patented in the United States "a screw or spiral lever for propelling."

The same year the first steamer arrived at Chicago, Illinois. Nothing could exceed the surprise of the sons of the forest on seeing this steamer move against wind and current without sails or oars. They lined the shores and expressed their astonishment by repeated shouts of "*Taiyoh nichee!*" an expression of surprise. A report had been circulated among them that a "big canoe" would soon come from the noisy waters, which by order of the Great Father of the "Chemo Komods" (*Yankees*), would be drawn through the lakes and rivers by a sturgeon, and this served to verify the report.

1832.—March, 1832, Bennett Woodcroft, author of a "History of Steam Navigation," patented a screw formed by a circular line coiled round a cylinder, increasing the pitch throughout the length and producing greater speed with fewer revolutions, to be fixed forward of the middle post by cutting away part of the deadwood. Sauvage also experimented this year.

The introduction of wrought-iron hulls for steam-vessels has introduced great improvements. It enabled builders to effect a combination of strength and lightness of draught peculiarly advantageous in some branches of trade and in certain localities. The "Alburkha," of fifty-five tons, built to accompany the "Quorra" in the expedition to the Niger, in 1832, gave great satisfaction. Messrs. Laird, of Liverpool, the builders of these vessels, immediately commenced the "Garryowen," designed to run between Limerick and Kilrush. This vessel was one hundred and twenty-five feet on deck, its beam twenty-one feet six inches, and its engines were fifty horse-power each. The "Garryowen" was driven on shore in the great hurricane which happened about that time, but escaped uninjured. This evidence of the power of iron vessels to withstand the casualties of the sea so raised their estimation that their number was rapidly increased and their size greatly extended. The "Garryowen" was the first steamer built that had a regular arrangement of water-tight bulkheads.

Earlier than these Niger vessels, and the first steam-vessel ever constructed of iron, was the "Aaron Manby,"[34] launched in 1820, and named for her builder. She was constructed at the Horsely Iron-Works in sections, and was sent to London and put together in dock. September, 1821, Captain—afterwards Rear-Admiral—Sir Charles Napier, who was a partner in the speculation, took charge of her and navigated her from London to Havre, and thence to Paris, without unloading any part of her cargo. She was the first, and for thirty years afterwards the only, vessel that sailed direct from London to Paris. In 1843 she was in good condition, and up to that time had required no repairs on her hull. She was broken up in 1855, after thirty-five years' service.

1833.—H. B. M. steam-packet "Firebrand" in sixty-six days traversed eleven thousand five hundred miles of sea in two voyages from Falmouth to Corfu, and one from the same port to Lisbon. In the same year the "Royal William," of one thousand tons burden and one hundred and eighty horse-power engine, built on Three Rivers, in Lower Canada, made the voyage from Pictou, Nova Scotia, to Cowes, in the Isle of Wight, being the third transatlantic voyage[35] of a steamer. She was employed for three or four years between England

[34] Previously noted.

[35] The "Savannah," 1819, from Liverpool, was the first; the "Curaçoa," from Antwerp to Curaçoa, the second.

and Ireland, and afterwards made several voyages across the Atlantic. The people of the provinces claimed for her the credit of the first ocean transit by steam. The Historical Society of Chicago has now in its possession the original working plans of this vessel, presented by James Gonchie, an old Scotch ship-builder, who in 1880 was a resident of that city. She was launched at Quebec in 1831, and made the trip from Pictou to London in twenty-five days. In 1837, The City of Dublin Steam Packet Company purchased the "Royal William," and she made the voyage from Dublin to Liverpool, October 9, 1837, in nine hours and forty-eight minutes. She was soon after sold to the Spanish government for ten thousand pounds, and converted into a man-of-war. She sailed from Pictou to cross the Atlantic April 1, 1833.

1834.—The first steamer on the Merrimack River, Massachusetts, was the "Herald." She was built above the Pawtucket Falls, launched in 1834, and made regular trips between Lowell and Nashua when Lowell had only fourteen thousand inhabitants and Nashua a few hundred. In 1838 she was lengthened to ninety feet, and would carry five hundred passengers. In 1840 she was floated over the falls to Newburyport, and thence taken to New York, where she was run as a ferry-boat between New York City and Brooklyn.[36]

1835.—John F. Smith, of Charlestown, Massachusetts, September 18, 1835, patented a screw revolving in a cavity made by giving the hull the form of a double vessel from about amidships to the stern, the forepart being in the ordinary shape.

Edward P. Fitzpatrick, of Mount Morris, New York, November 23, 1835, patented a spiral screw, the shaft swelling in the middle like a double cone, surrounded by a spiral thread, also wider in the middle than at the ends.

In 1836 the whole number of French steamboats was eighty-two, the majority of small size, suited to the navigation of the shallow French rivers. Forty-four were passenger boats, seventeen freight boats, twenty-one employed in towing ships. The aggregate steam power of the eighty-two steamboats was two thousand eight hundred and sixty-three, an average of about thirty-five horse-power to each boat. The average tonnage was estimated at one hundred and eighty tons, or fifteen thousand in all.

Twenty-seven steam-vessels were also in the naval service, eighteen afloat, six on the stocks, and three employed as tugs of the eighteen afloat. Eleven had one hundred and sixty horse-power each, and seven one hundred and fifty horse-power and under, and were armed with six guns each, two being Paixhan or steel guns. Fifty-four steam-vessels were also preparing for the service of the Post-Office Department in the Mediterranean.

[36] *Newburyport Herald.*

THE FIRST STEAMERS IN CHINA.

In the "Life of E. C. Bridgeman, the Pioneer of American Missions in China," the arrival of the first steamer at Macao is thus mentioned in his diary:

"*May 1st*, 1830.—Arrived at Macao on the 19th (April) in the steamer 'Forbes,' the first ship of the kind that has ever visited these shores. She's a wonder to the Chinese; they call her *Fo Shune*,—The Fire-Ship."

In 1835 an attempt was made by the foreign residents to place a small steamboat called the "Jardine" upon the Canton River, to run between Lintin, Macao, and Whampoa. Owing to the opposition of the Chinese authorities, as shown in the following correspondence, the undertaking was temporarily abandoned. The editor of the *Canton Register* remarks: "We understand that the project of running the steamer in the way set forth in the letter is not abandoned, notwithstanding the deputy-governor's refusal to accede to the proposition of the whole of the foreign community of Canton. Perhaps the arrival of the new governor will be a favorable opportunity to reurge this reasonable and judicious plan of communication with the shipping at Lintin and with Macao. A united and determined perseverance on the part of the foreigners is all that is wanted to carry this or any other reasonable project into effect.

"We notice with unfeigned pleasure the unanimous feeling of the foreign community on this subject. The name of every foreign merchant in Canton was signed to the letter to Howqua, including the three East India Company's agents, whose names head the list *O si sic omnia*."[87]

"To Howqua, Senior Hong Merchant —— Canton:

"Sir,—We the undersigned, merchants of all nations residing at Canton, having for years past experienced much inconvenience from the tardiness and uncertainty of our communication with Macao, where our wives and children reside, as well as from the difficulties attending the conveyance of letters to and from vessels arriving and departing, have lately procured from Europe, at a considerable expense, a traveling boat of a modern construction propelled by steam and capable of moving against wind and tide.

"The said boat having arrived at Lintin, we intend to order her up without delay; and, as the officers stationed at the different forts, never having seen a traveling boat of this description, may entertain erroneous ideas regarding her, and may attempt to impede her passage up the river, which might terminate in disaster, the motive of our now addressing you is to request the favor of your forwarding a true statement to the government officers in order to preclude the possibility of misunderstanding or trouble.

[87] *Canton Register*, December 29, 1835.

"Being all personally known to you, it is superfluous to assure you of our peaceable dispositions and the rectitude of our intentions.

"Our boat is purely a passage-boat, and no cargo can ever be admitted. Neither is she provided with a defensive weapon of any description, such is our unbounded confidence in the protection of the Imperial government. Any officer doubting our statement can satisfy himself by personal inspection.

"The regularity of communication thus established will leave no inducement to resort any longer to Chinese fast-boats for the conveyance of letters or passengers, which has so frequently led to petitioning at the city gate, removing at once one of the chief sources of trouble to the Hong merchants as well as to ourselves.

"The boat is expected at Canton in seven days, when we shall be happy to see you, sir, or any gentleman of your honorable country, on board.

"With compliments we affix our names.

"We herein state her length 85 feet, beam 17 feet, draft of water 6 feet. Reduced to Chinese feet in the Chinese letter, being 70 feet length, 14 beam, 5 draft of water."

FROM THE HONG MERCHANTS.

"We respectfully inform you, benevolent elder brethren, that yesterday we received your letter, the contents of which we immediately submitted to the *Tuhheën*. Now we have received the *Tuhheën's* reply, which we have faithfully transcribed, and we present it praying that you, benevolent elder brethren, will all inform yourselves thereof. You, gentlemen, and the established authorities of your honorable country, should obey the orders that the said steamship is not permitted to enter the port. When there are letters ships' boats, as heretofore, should be ordered to make a clear report and bring them up for delivery. We earnestly request your particular attention to this matter. Directed to Mr. Jardine and the constituted gentlemen for their information.

"Signed by *Wootaeyung*, and ten others.

"11th moon, 6th day,—25th December, 1835."

FROM THE ACTING GOVERNOR.

"*Ke*, guardian of the Prince, acting governor-general of the two *Kwang*, *Seunfoo* of Kwangtung, proclaims to the Hong merchants, who have presented the petition of the English foreign merchant *Tanele* (Daniell) and the others in reply—

"I have examined, and find that each ship of every nation arriving in the Chinese waters (of Canton province) have hitherto been cargo-ships, and, consequently, they have been permitted to come up to

Whampoa; with these exceptions, ships are not allowed to enter the port. As the ships that remain at anchor in the offing have letters for delivery and such-like business, heretofore it has been the custom to order ships' boats to make a clear report at the custom-houses, and then allow them to enter the port; these are the reported and fixed regulations. Now, as the English have brought hither a steamship, it is proper to manage the affair agreeably to the regulations. The said Hong merchants must immediately transmit the orders to the foreigner of the said steamship that if he has letters he should order ships' boats to make a clear report, and then enter the port and deliver the letters, he must not hastily bring in the steamship; if he presumes obstinately to disobey, I, the acting governor, have already issued orders to all the forts that when the steamship arrives they are to open a thundering fire and attack her. On the whole, since he has arrived within the boundaries of the celestial dynasty, it is right that he should obey the laws of the celestial dynasty. I order the said foreigner to ponder this well and act in trembling obedience thereto.

"TAOUKWANG, 15th year, 11th moon, 6th day,—25th December, 1835."

The following edict from the Hoppo was received a few days later:

"*Pang, by imperial appointment controller-general of the customs at Canton, etc.:*

"I have examined and find that the reported and fixed regulations are that the foreign ships of every nation, when they arrive in the waters of Canton, should, as the law directs, make a clear report and receive a pilot to bring them up to Whampoa. In the transmission of letters hitherto open boats have been used to enter and leave the port, which waited to be examined; this has been the custom for very many years, and there has neither been delay nor impediment; and most assuredly these regulations are unchangeable. It is now authenticated that the English have petitioned respecting a newly-built steamship; this is scarcely a credible affair. She is not permitted to enter the port. I order the head Hong merchant and all the others immediately to direct their most assiduous attention to the explanation of the orders to the said foreigners, that they should be obedient to the fixed regulations as established by the emperor, and that they should use ships' small open boats for the conveyance of letters in going and returning, and reverently obey the laws of the celestial dynasty; they are not allowed presumptuously to make changes and oppose the prohibitory laws. Forthwith obey my former orders on this business, and await the reply of the acting governor.

"TAOUKWANG, 15th year, 11th moon, 9th day,—December 28, 1835."

The doubt expressed by *Pang* in the above reply as to the credibility of the affair of the steamer is pointed at the manner in which he supposes she may be employed; he does not believe that she is merely

intended as a passage-boat and packet, and seems afraid there is some ulterior design on the part of the foreigners.[88]

In Williams's "Middle Kingdom" (vol. i. pp. 573, 574, edition 1876) is a description of a steamer which "was attached to drawings made by the Chinese when the English attacked Canton in 1841:"

"She's more than three hundred cubits long,
And thirty-odd in height and breadth;
Iron is used to bend her stiff and stout,
And she's painted black all round about;
Like a weaver's shuttle is her shape;
On both sides carriage-wheels are fixed,
And, using fossil coal to make a fire,
They whirl around as the racehorse flies.
Of white cloth all the sails are made.
In winds both fair and foul she goes.
On her bow is the god of the waves,
At stem and stern is a revolving gun;
Her form is truly terrific to men.
The god of the North displaying his sanctity,
The sunken rocks there shoaled the steamer;
All who saw it witnessed to the justice of heaven.
None of the plans of the foreigners took effect,
Which greatly delighted the hearts of men."

In this connection, referring to the American steamers trading in Canton waters, Mr. Gideon Nye wrote a friend as follows:

"Premising that several steamers under the British flag preceded the coming of any but a very small one under our own, I merely recall that this one was the 'Fire Fly,' sent out in pieces by R. B. Forbes, Esq., of Boston, to run between Canton and Whampoa; that he sent next the 'Spark' (that is still running to Macao, after having been lengthened about sixteen feet), also in pieces, chiefly for account of the late Mr. J. B. Endicott; and another, called the 'Midas,' that went hence to Brazil. These all came out during my absence from Canton,—that is, after 1845 and before 1850.

"During the same period three British steamers were running between Canton and Hong Kong,—the 'Corsair,' the 'Canton,' and the 'Hong Kong.' In 1854 the late Mr. Robert Sturgis, Mr. J. B. Endi-

[88] "The steamer 'Jardine' was sailed out as a schooner from Aberdeen (Scotland), and arrived in September, 1835, at Lintin, where her machinery was put in working order; and she made several trips to the Bogue (Bogga Tigris) in November, being intended as a passenger and mail conveyance between Macao, Lintin, and Canton. But, although every foreign merchant residing at Canton signed a letter to Howqua for submission to the governor, stating the purpose of her employment and engaging that she should be restricted to it, the chief authorities refused consent to her entering the river; and this was peremptory, notwithstanding the admiral's disposition to admit her, having visited her and allowed her to take his own junk in tow up and down Anson's Bay, after which he freely acknowledged that there could be no harm in her running."—GIDEON NYE, in *China Review*, Hong Kong, 1875.

cott, and myself sent to New York for a larger class steamer for this river trade, and in her (under command of Captain Sampson) came the late Captain George U. Sands as chief engineer; she being called, I think, the 'Fung Shung' when she left there, but the new name of 'River Bird,' suggested by my partner, Mr. Tuckerman (late U. S. Minister in Greece), was given her here. In 1854 the steamer 'Carolina' was bought for me in California, and brought over by Captain Sampson in 1855; but I sent her to Calcutta, where also the 'River Bird' was sent by Mr. Sturgis after the war of 1856 stopped the river traffic. Hostilities here continued until 1860, though after the treaty of Tientsin, in 1858, there was a partial resumption of business. Meantime, Captain Sampson had returned to California and brought over the 'Williamette.' Soon after the 'White Cloud' came out from New York, chiefly for Mr. Sturgis and Captain Sands's account, and next the 'Hankow,' both under steam, followed later by the 'Kiushau' in pieces, to be set up at Whampoa. The 'Fire Dart' was sent down from Shanghai, followed thence, later, by the 'Po-yang' and 'Kiu-Kiang.' The 'Hankow' was destroyed by fire here, and the 'Po-yang' was lost in a typhoon near Macao."[39]

PROPOSED AMERICAN IRONCLAD AND TORPEDO-VESSEL, 1836.

The New York *Times* says,[40] "Clinton Roosevelt of that city has invented an invulnerable steam battery. It is rendered invulnerable by making the bow and stern of the vessel alike sharp and plating them with polished iron armor, with high bulwarks, and a sharp roof also plated in like manner, with the design of glancing the balls. The means of offense are a torpedo which is made to lower on nearing an enemy, and be driven by a mortar into the enemy's side under water, where by a fusee it will explode. There is also a large cannon at each end of the battery, also mortars to throw combustibles upon the sails and decks of opponents. There are means to prevent balls from reaching any part of the machinery, and his design is always to fight the vessel end-on."

This device appears never to have been put to any practical experiment, but it will be seen most of the ideas have since been adopted or incorporated in vessels of later date.

1836.—A model of Commodore James Barron's prow-ship was exhibited in the rotunda of the Capitol at Washington in 1836, and is now preserved in the Seamanship building at the Naval Academy, Annapolis, Maryland. Its inventor thus described this, the first steam ram ever proposed, under date February 11, 1836:

[39] See *Army and Navy Chronicle*, January 29, 1836.

[40] Gideon Nye, author of "History of American Commerce with China," to Thomas Gibbons.

"ON THE APPLICATION OF STEAM-POWER TO THE PURPOSES OF WAR.

"I would propose that a vessel be constructed of solid logs of light timber, the gravity of which would not exceed four-tenths that of water, and be of such bulk that the upper part of the solid log-work of the centre vessel would float six or eight feet above its surface.

"Let this vessel, or combination of vessels, be of large dimensions, say from one hundred and fifty to two hundred or two hundred and thirty feet long, and seventy or eighty feet wide, and resembling in their form a steamboat of the treble construction. The prow should be very strong, and for a few feet aft a little sharp; but not so much so as to impair its strength. The point of it should not be reduced to a less thickness than three or four feet, and not exceeding in its whole length beyond the bow of the centre vessel fifteen or twenty feet, and that prominence covered with iron plates from three to four inches thick, eight or ten inches wide, and six or eight feet long on each arm, formed into an acute angle to fit the shape of the prow, and enlarged at their junction on the point of the prow to about eight or ten inches in thickness, and rounding outwards in sharp-pointed knobs, cut in large diamond form. These plates should be placed four or five inches apart from each other, and let half their thickness into the wood, which will produce a saw-shaped space upon the prow, and prevent the glancing of the vessel from her object, either up or down, or sideways.

"The logs that form the prow should be at least two feet square, thirty or forty feet long, and of the hardest and toughest wood, such as oak or elm, and occupy a space of ten or twelve feet up and down, and be supported on each side by the same kind of timber. The iron plates should be securely bolted through the whole mass, but particularly so through these logs of hard timber. To protect the crew and machinery from shot, let the guard-vessels without the centre vessel be built twelve or fifteen feet wide, and of the solid white pine timber, and projected a sufficient distance from the sides of the centre vessel to embrace the paddle-wheels. These barricado vessels should be of sufficient elevation to cover the upper part of the paddle-wheels. Each of the lower parts must form a bottom similar to the centre one, and be secured to it forward and aft by the cross logs of which the centre vessel is constructed, projecting from her sides to such a distance as to allow spaces for the paddle-wheels on each side, and from as many points above the water between the paddle-wheels as might be required for strength.

"The water is admitted to these paddle-wheels between the bows of these vessels through a channel formed by a long inverted arch, the lowest point of which must descend below the level of the lower part of the wheels. The solid log-work, forward and aft of the centre

vessel, should form a mass of at least twelve or fifteen feet in thickness, or as the side vessels.

"Over the top of these vessels lay a tier of logs about two feet square, which will serve as a protection to the crew and machinery from any assaults by boarding, etc. The middle vessel may be hollowed out, at a proper distance from her extremes, if more buoyancy is required than the timber itself gives, except amidship, and there the log-work should be continuous from the prow all the way aft.

"The object of this vessel is to destroy men-of-war by running into them with such impetuosity as to break down their sides sufficiently to admit water in such quantities as would defy all possible efforts to prevent immediate sinking.

"Only about ten or twelve feet of the prow of this vessel ought to be allowed to strike the ship that is assailed; the other parts, above and below, should recede or incline aft, and this ten or twelve feet space should be so situated as to come in contact with the side of the enemy five or six feet above the water and five or six feet below its surface. The resistance to the stroke would be less impeded than it would be were it given by a prow of greater extent, and of course it would be more certain to pierce or break down that part of the side of the enemy's ship which it might come in contact with. Three steam-engines, of one hundred and twenty horse-power each, would propel such a vessel at the rate of eight or ten miles, or more, per hour, and should be preferred to larger ones, as they would be less liable to damage from the shock to which they might be exposed when the vessel should come at her full speed in contact with the enemy.

"Let those who are curious or doubtful of the efficiency of this plan calculate the effect which would be produced on a stationary body by a concussion so violent as would be occasioned by a stroke of the prow of this massive vessel. To make it apparent that the strongest ships in the world are entirely inadequate to resist such force, it need only be observed that they seldom come in contact with each other with any violence without sinking or sustaining a most destructive degree of damage.

"Ancient as well as modern history furnishes us with many proofs of the decided effects of this mode of attack. The Romans and Carthaginians were in the practice of running into each other's vessels at their greatest speed, impelled by their oars; and it is recorded of them that when they found their enemies entangled with their friends, so as to render them stationary for the moment of their assault, that it seldom failed to produce that description of destruction contemplated by the adoption of this invention; but the power of steam and the solid construction of this vessel would give this mode of attack a decided advantage over all other attempts of a similar nature ever heretofore resorted to, and beyond a doubt insure success.

"The proof of the effects of an attack made by a whale on the ship 'Essex' of New Bedford, in the year 1819, is conclusive that no construction of a ship now known could resist the shock of such a vessel as the one I have described. A circumstance not very dissimilar occurred to Captain Jones, in the United States ship 'Peacock,' in the Pacific Ocean.

"The instances of destruction occasioned to vessels by one running into another are too numerous to admit of a doubt that if the plan recommended above should be adopted on a proper scale, it could ever fail of effecting its object.

"The rudder is attached to the centre vessel, and must be moved by a wheel, which may be placed on the upper surface of the centre vessel, under the roof or main covering, either forward or aft; but I should prefer its being aft, and it should be considerably forward and lower down than in ordinary cases. A breast-work should be raised aft, for the protection of officers and others; also for the chimneys and steam-pipes, in their proper places, which should be circular.

"The timber alluded to in the above description is the white pine,—'*Pinus Strobus*,'—poplar,—'*Liriodendron tulipifera*,'—and some species of the gum, none of which exceed four-tenths of the gravity of water.

"The prow mentioned in the first part of this description is not of such a form as I would either use myself or recommend to those whom I would allow to use my invention: that form might become fixed in the body assailed, but the form represented by the drawing will surely clear itself.

"In speaking of the different presentations of the prow and its momentum, it is to be considered as in contact with a solid body.

"Dimensions, etc., of the steam prow-ship:

	Length. *feet.*	Width. *feet.*	Depth.	Number of Cubic Feet.
"Middle vessel . . .	150	20	30	90,000
Side vessels . . .	each 125	12	30	both 90,000

Number of cubic feet in the three vessels, 180,000.

Weight of each cubic foot of white pine in the three vessels, 24 pounds.

Specific gravity of the three vessels, 4,320,000 pounds, or 1968 tons.

Specific gravity of the three vessels multiplied by their velocity gives, as the whole momentum of the three vessels, 43,200,000 pounds.

Momentum on each foot of the prow, 900,000 pounds."

1836.—The number of registered steam-vessels in Great Britain in 1836 was three hundred and ninety-seven. One hundred and fifty-three were under fifty tons, and one hundred and eighteen more under one hundred tons. The number above one hundred tons was one hundred and twenty-six. The largest, the "Monarch," of London, measured only five hundred and eighty-seven, and no other exceeded four hundred tons. The newspapers of this year speak of "an *immense*

steam-frigate, to be called the 'Gorgon,' to be built in London. She is to be eleven hundred tons, and will carry twelve guns, larger than the old seventy-fours."

In 1837 the number and tonnage of steam-vessels belonging to the British empire distinguishing British possessions in Europe from the British plantations, was

	Vessels.	Tonnage.
England	432	87,240
Scotland	109	13,368
Ireland	87	18,437
Total for United Kingdom	618	69,045
Isles of Guernsey, Jersey, and Man	6	882
British Plantations	44	8,411
Total for all	668	78,288

THE FIRST PRACTICAL SCREW STEAMERS.

1836.—Captain John Ericsson, a native of Sweden, who had held a commission in the Swedish army, but for some time previous to the date of his patent for propelling vessels a resident in England, and well known as a mechanician of originality and skill, obtained a patent in England, in July, 1836, for a propeller consisting of two broad thin hoops with eight fans, each fixed on a shaft, the outer hoop revolving in a contrary direction and at a greater velocity to the inner one. This propeller was to be entirely submerged *abaft* the rudder, the shaft passing through the stern-post, the rudder being divided into two parts, connected by a strong iron stay on each side, having a wide bend to allow the rudder to traverse clear of the shaft. Prior to the construction of his first vessel Captain Ericsson experimented in a circular bath in London with a model boat, which was propelled by means of a screw. This model boat was fitted with a small engine supplied with steam by a pipe leading from a steam-boiler over the centre of the bath and descending to within a foot of the water-line, where it was branched off by a swivel-joint and connected with the engine in the boat. Steam being admitted in this pipe, the engine in the boat was put in action, and motion was thus communicated to the propeller. This model, though less than three feet long, performed its voyage about the basin at the rate of upwards of three miles an hour.

His next step in the invention was the construction of a wooden boat 45 feet long, 8 feet beam, 3 feet draught of water, with *two propellers*, each of 5 feet 2 inches in diameter. So successful was this experiment that when steam was turned on for the first time the boat moved at once upwards of ten miles an hour without any alteration in her machinery. This vessel was named by the inventor the "Francis B. Ogden," in compliment to the United States consul at Liverpool, who was the first to appreciate and encourage his efforts. The vessel was

built at Wapping, by Mr. Gulliver, boat-builder, and was constructed solely for the purpose of testing Ericsson's propeller.

The following description of her motive power was published in the *London Mechanic's Magazine*, for June, 1837:[41]

"The propelling apparatus is placed at the stern, and works entirely under the water. It consists of a peculiar application of the old and well-known principle of the water screw, by which a great propelling power is concentrated in a small space. Of the degree of power concentrated no better proof can be adduced than the fact that the speed of 4½ knots, against wind and tide, was produced by an apparatus measuring only 5 feet 2 inches in diameter and 2 feet 2 inches wide, weighing only 615 pounds, and worked by a high-pressure engine having 2 cylinders of 14 inches stroke and 12 inches diameter, and which, during the experiment, made only 60 strokes per minute, and showed a pressure of not more than 50 pounds on the square inch. The new propelling apparatus consists of two short cylinders of thin wrought iron supported by arms of a peculiar form, which are placed entirely under the water at the stern and made to revolve in contrary directions round a common centre. To the outer periphery of each cylinder is attached a series of spiral planes or plates, which may be placed at any angle, according to the effect sought to be obtained, whether it be great speed or great propelling power.

"The apparatus may be made to ship and unship at pleasure; the engine that works it may also be loco-movable, so as to be worked upon deck and any part of the deck; and in these two peculiarities we are inclined to think the chief advantage of this new step in steam navigation will be found to consist. Sailing-vessels may by this means command all the aid that steam can give them without divesting themselves of any of their peculiar fitness for long sea voyages or undergo any change in their original construction."

As already noticed, the "Ogden" when first tried upon the Thames, in April, 1837, attained a speed of ten miles an hour. She subsequently towed schooners of one hundred and forty tons at the rate of seven miles an hour, and the American packet-ship "Toronto," of six hundred and fifty tons register, at the rate of more than five English miles an hour, according to the following certificate:

"PACKET-SHIP TORONTO,
"IN THE THAMES, 28th May, 1837.

"We feel pleasure in certifying that your experimental steamboat, the 'Francis B. Ogden,' has this morning towed our ship at the rate of 4½ knots through the water, and *against* tide.

"E. NASHLY, *Pilot*,
"H. R. HOOEY, *Mate*.

"To CAPTAIN ERICSSON."

[41] Vol. xxvii. p. 180.

The engineers of London looked upon the experiment with silent neglect, and when the subject was laid before the British Admiralty it failed to attract favorable notice. Accounts of the experiments appeared with favorable mention in the *Times*, and other public journals; also in the *Civil Engineer's and Architect's Journal*, the *London Journal of Arts and Sciences*, the *London Mechanic's Magazine*, and similar publications.

Perceiving its peculiar and admirable fitness for ships-of-war, Ericsson was confident that the Lords of the Admiralty would at once order the construction of a war-steamer on the new principle. He therefore invited them to an excursion in tow of his experimental boat. Accordingly, the gorgeous Admiralty barge was ordered to Somerset House, and Ericsson's little steamer was lashed alongside of it.

A lecture before the Boston Lyceum in December, 1843, by John O. Sargent, supplies the following graphic description of the trip:

"The barge contained Sir Charles Adam, Senior Lord of the Admiralty; Sir William Symonds, Surveyor of the British Navy; Sir Edward Parry, the commander of the Second British North Pole Expedition; Captain Beaufort, the Hydrographer of the Royal Navy; and other scientific and naval officers.

"In anticipation of a severe scrutiny from so distinguished a personage as the chief constructor of the British navy, the inventor had carefully prepared plans of his mode of propulsion, which were spread on the damask cloth of the magnificent barge. To his utter astonishment, as we may well imagine, this scientific gentleman[42] did not appear to take the slightest interest in his explanations. On the contrary, with those expressive shrugs of the shoulder and shakes of the head which convey so much without absolutely committing the actor,—with an occasional sly, mysterious, undertone remark to his colleagues,—he indicated plainly that though his humanity would not permit him to give a worthy man cause for unhappiness, yet 'he could an' if he would' demonstrate by a single word the utter futility of the invention.

"Meanwhile the little steamer proceeded at a steady progress of ten miles an hour through the arches of the Southwark and London bridges towards Limehouse, and the steam-engine manufactory of the Messrs. Seaward. Their lordships having landed and inspected the huge piles of the marine engines intended for his Majesty's steamers, with a look at their favorite propelling apparatus, the 'Morgan paddle-wheel,' reembarked, and were safely returned to Somerset House by the noiseless and unseen propeller of the new steamer.

"On parting, Sir Charles Adam, with a sympathizing air, shook Ericsson cordially by the hand, and thanked him for the trouble he had been at in showing him and his friends this interesting experiment, adding that he feared he had put himself to too great an expense

[42] Sir Charles Adam, Senior Lord of the Admiralty.

and trouble. Notwithstanding this ominous ending of the day's excursion, Ericsson felt confident that their lordships would not fail to perceive the importance of the invention. To his surprise, however, a few days afterwards a letter written by Captain Beaufort, at the suggestion, probably, of the Lords of the Admiralty, was put into his hands, in which that gentleman, who had witnessed the experiment, expressed his regret that their lordships had been very much disappointed at its results. The reason was altogether inexplicable to the inventor; for the speed attained at the trial far exceeded anything that had been accomplished by any paddle-wheel steamer on so small a scale.

"An accident soon relieved his astonishment. The subject having been started at a dinner-table where a friend of Ericsson was present, Sir William Symonds ingeniously remarked that 'even if the propeller had the power of propelling a vessel, it would be found altogether useless in practice, because, the power being applied in the stern, it would be absolutely impossible to make the vessel steer.' It may not be obvious to every one how this naval philosopher derived his conclusion; but his hearers doubtless acquiesced in his oracular proposition, and were amused at the idea of 'undertaking to steer a vessel when the power was applied in her stern.'

"But we may well excuse the British Admiralty for exhibiting no interest in the invention when the engineering corps of the empire arrayed itself in opposition to it, alleging that it was constructed upon erroneous principles and was full of practical defects; regarding its failure as too certain to authorize any speculation of its success. The plan of screw propulsion was specially submitted to many distinguished engineers, and publicly discussed in the scientific journals; and there was scarcely any one but the inventor who refused to acquiesce in the numerous demonstrations proving the vast loss of mechanical power which must attend the substitute for the old-fashioned paddle-wheel."

In August, 1837, a lithograph of the apparatus of the "F. B. Ogden" was published in London. The machinery was subsequently removed from her and applied to other purposes.

In the winter of 1837, a canal boat called the "Novelty" was fitted with Ericsson's propeller, and was set to ply on the canal between Manchester and London, England. The propellers were only two feet six inches in diameter, and were driven by an engine of only ten horse-power; nevertheless, the boat realized a speed of eight or nine miles an hour. This is the first example of a screw boat being employed for commercial purposes, but she was in a short time laid up, owing to the failure of her owners.

Although Ericsson's invention was thus treated with indifference by the highest naval scientific authority of England, Mr. Ogden did not lose his interest or belief in it. He was himself distinguished for his attainments in mechanical science, and is entitled to the honor of

having first applied the principle of the expansive power of steam, and of having originated the idea of right-angular cranks for marine engines. His practical experience and long study of the subject—for he was the first to stem the waters of the Ohio and Mississippi, and first to navigate the ocean by steam alone—enabled him at once to perceive the truth of the inventor's demonstrations.

Other circumstances soon consoled Ericsson for his disappointment in the rejection of his propeller by the Admiralty. The subject was brought to the notice of Captain Robert F. Stockton, U.S.N., then on a visit to London, who was induced to accompany the inventor in one of his experimental trips on the Thames. Captain Stockton is to be credited with being the first naval officer who dared to act upon the suggestions of Ericsson as to the application of his propeller to ships-of-war. At the first glance he saw the importance of the invention, and his acute judgment enabled him to predict that it was destined to work a revolution in naval architecture. After making a trip in the "Ogden," from London Bridge to Greenwich, he ordered Mr. Ericsson to build for him forthwith two *iron* boats, for the United States, with steam machinery and propeller on the plan of his invention rejected by the British Admiralty. "I do not want," said Captain Stockton, "the opinions of your scientific men: what I have seen this day satisfies me." At a dinner at Greenwich, Captain Stockton made several predictions and promises in respect to the new invention, all of which have since been realized. To the inventor he said, in words of no unmeaning compliment, "We will make your name ring on the Delaware as soon as we get the propeller there."

Not only did Captain Stockton order, on his own account, the two iron boats referred to, but he at once brought the subject before the government of the United States, and had numerous plans and models made at his own expense explaining the peculiar fitness of the new invention for ships-of-war. So completely was he persuaded of its importance, and so determined his views should be carried out, that he assured the inventor the government of the United States would test the propeller on a large scale; and so confident was Ericsson that the perseverance and energy of Captain Stockton would accomplish what he promised that he abandoned his professional engagements in England and set out at once for the United States.

Prior to leaving England, however, he built for Mr. John Thomas Woodhouse an iron screw propeller vessel, to run as a passenger-boat on the Ashby-de-la-Zouch Canal, which was named the "Enterprise." Her length was about 70 feet; beam, 7 feet; and her engines about 14 horse-power; her speed, from 9 to 10 miles an hour. She commenced running on the canal in August, 1839, and, having run the season through without profit, was afterwards used as a steam-tug on the Trent and Mersey.

The *Naval Magazine* for November, 1837, published at New York under the auspices of the United States Naval Lyceum, and which contains a description and drawing of Ericsson's propeller for steamboats, says, "We do it from a conviction that this ingenious engineer has discovered a most valuable improvement in the mode of propelling vessels by steam," and adds, "If it succeeds on a large scale as well as it has on the trials already, it must create an entire revolution in the mode of propelling by steam."

The iron vessel built for Captain Stockton was launched from the yard of Messrs. Laird & Co., of Birkenhead, the 7th of July, 1838, and was the named the "Robert F. Stockton." A drawing of this vessel as she was rigged for her voyage across the Atlantic illustrates Woodcroft's "History of Steam Navigation."

On a trial made below Blackwall the 12th of January, 1839, in the presence of about thirty gentlemen, a distance of nine miles (over the land) was passed in thirty-five minutes with the tide, proving her speed through the water to be between eleven and twelve miles an hour. The "Stockton" was 70 feet long, had 10 feet beam, and drew 6 feet 9 inches of water. The diameter of her propeller was 6 feet 4 inches.

To test the power of her propeller, she was made to tow four coal barges with upright sides and square ends, each of about fifteen feet beam and drawing four and three-quarter feet of water, from Southwark to Waterloo Bridge. Steam being set on, full speed was attained in one minute, and the distance between the bridges, which is precisely one mile, was performed in eleven minutes.

Considering the square form of the barges, and that they presented together 59 feet 1 inch beam, with an average draught of 4 feet 4 inches, besides the sectional area of the steamer, which was 43 square feet, and that the propeller, only 6 feet 4 inches in diameter, occupied less than 2 feet 6 inches in length behind the stern of the boat, the result was considered very satisfactory.

The "Robert F. Stockton" left England for the United States early in April, 1839, under the command of Captain Crane. Her crew comprised four men and a boy. She was forty days making the passage under sail, and for his daring in crossing the Atlantic in this small vessel Captain Crane was presented with the freedom of the city of New York. Her machinery was so arranged that either one or two propellers could be used. In her experiment on the Thames she was worked with a single propeller.

In 1840, Captain Stockton sold the "R. F. Stockton" to the Delaware and Raritan Canal Company, permission having been obtained, by a special act of Congress, to run her in American waters, her name at the same time being changed to that of "New Jersey." From that date she was in constant employment as a steam-tug on the Delaware and Schuylkill, both winter and summer, as she was the only vessel

capable of towing through the drift ice, paddle-wheel steamers being of little use for that purpose. The "New Jersey" was the first screw-propeller vessel practically used in America, although numerous unsuccessful experiments with the screw had been previously made.

In the autumn of 1839, Ericsson came to the United States, and died at Richland, New York, March 5, 1869.* Before he had been long in America he had an opportunity of introducing his propeller into the United States navy.

The "Princeton" war-steamer was built and fitted with Ericsson's screw; the engines were also designed by him, and were so constructed as to lie beneath the water-line, and, therefore, more out of reach of shot. These were the first engines made upon this principle. When Ericsson left England he consigned his interests to the guardianship of Count Adolph E. de Rosen, and in 1843 Count Rosen received an order from the French government to fit a forty-four gun-frigate, the "Pomone," with a propeller on Ericsson's plan, with engines of two hundred and twenty horse-power, which were to be kept below the water-line. In 1844 the English government had the "Amphion" frigate fitted on the same plan, with engines of three hundred horse-power. These were the first engines in Europe which were kept below the water-line. They were also the first direct-acting horizontal engines employed to give motion to the screw. Both vessels were completely successful.

1836.—In 1835, Francis P. Smith, a farmer at Hendon, first directed his attention to screw propulsion. In the spring of 1836 he obtained the co-operation of Mr. Wright, a banker, and his first patent was granted the 31st of May, 1836. A model boat, constructed under his supervision and fitted with a wooden screw, was then exhibited in operation upon a pond on his farm at Hendon and at the Adelaide Gallery in London. At the Adelaide Gallery it was inspected by Sir John Barrow, the secretary of the Admiralty, and Messrs. Harris & Bell, of Alexandria, offered to purchase the invention for the Pasha of Egypt; but their offer was declined.

The results with the model boat were so satisfactory that in the autumn of 1836 Mr. Smith and his friends constructed a boat of six tons burthen, and about six horse-power, to further demonstrate the advantages of the invention. This boat was fitted with a wooden screw of two turns. On the 1st of November, 1836, she was exhibited to the public in operation on the Paddington Canal, and continued to ply there and on the Thames until the month of September, 1837. During one of her trips on the Paddington Canal, in February, 1837, an accident occurred which first pointed out the advantage of diminishing the length of the screw. The propeller having come in contact with some object in the water, about one-half of its length was broken away, and no sooner had this been done than the boat quickened her speed and was found to realize a better performance than before. In conse-

* a mistake. he still lives 1888. - a Col. John Ericsson died above stated.

quence of this discovery, a new screw was fitted, of a single turn, and, with the vessel thus improved, very satisfactory results were obtained.

Although these experiments established in a measure the eligibility of the screw as a propeller for canal and river vessels, nothing had yet been done that was known or remembered to show that it was applicable to vessels navigating the sea. To this point, therefore, Mr. Smith directed his attention, and he determined to carry his small vessel to sea with the view of ascertaining if she would there exhibit the same efficiency displayed in canal and river navigation. Accordingly, on a Saturday evening, September, 1837, he proceeded in his miniature vessel from Blackwall to Gravesend, and, having at three in the morning taken in a pilot, went on to Ramsgate, and reached that place during divine service. From Ramsgate he proceeded to Dover, where a trial of the vessel's performance was made in the presence of Mr. John Wright and Mr. Peak, civil engineer. From Dover he went on to Folkestone, and thence to Hythe, returning again to Folkestone. The distance between Hythe and Folkestone, about five miles, was accomplished in three-quarters of an hour. On the 25th of September he returned to London, in weather so stormy and boisterous that it was accounted dangerous for any vessel of so small a size to put to sea. The courage of the undertaking, and the unexpected efficiency of the propeller, rendered the little vessel during this voyage an object of great interest; and her progress was watched with solicitude from the cliffs by nautical and naval men, who were loud in their praises. These favorable impressions reached the Admiralty, and produced a visible effect there.

In March, 1838, the Lords of the Admiralty requested Mr. Smith to have the vessel tried under their inspection.[43] Two trials were accordingly made which were considered satisfactory; and thenceforth the adoption of the propeller for the naval service was deemed not improbable.

Before finally deciding, however, upon the adoption of the propeller, the Lords of the Admiralty considered it desirable that an experiment should be made with a vessel of at least two hundred tons, and Mr. Smith and the gentlemen associated with him in the enterprise accordingly resolved to construct the "Archimedes." This vessel of two hundred and thirty-seven tons burthen was designed by Mr. Pascoe, laid down in the spring of 1838, and launched on the 18th of October following, and made her first trip in 1839. She was fitted with a screw of one convolution, which was set in the deadwood, and was propelled by two engines of the collective power of ninety horses. Her cost was ten thousand five hundred pounds. She was built under the persuasion that her performance would be considered satisfactory if a speed was

[43] This was a year or more after their trip in Ericsson's "F. B. Ogden."

attained of four or five knots an hour, and that in such an event the invention would be immediately adopted for the service of the navy. Nearly twice that speed was actually obtained.

After various trials on the Thames and at Sheerness, the "Archimedes," on the 15th of May, 1839, proceeded to sea. She made the trip from Gravesend to Portsmouth, under adverse circumstances of wind and water, in twenty hours. At Portsmouth she was tried against the "Vulcan," one of the swiftest steam vessels in Her Majesty's service. The trial took place before Admiral Fleming, Captain Crispin, and other competent authorities, who acquired from the result a high opinion of the efficiency of the screw as a propeller, which they expressed in writing to Mr. Smith.

The following description of the "Archimedes" is from the *Inverness Courier:*

"The 'Archimedes' is rigged as a three-masted schooner, with her masts raking. Her length is 125 feet; average draught of water, 10 feet; capacity, 240 tons; power of engines, 80 horses.

"The mode of propulsion may be said to be by a portion only of the Archimedean screw. When the vessel was first tried, a full turn of that species of screw was employed. The inventor afterwards, for the sake of compactness, introduced the double-threaded screw, with half a turn of each thread, as more applicable to this vessel, although he prefers the other. This is of iron, and is fixed in an opening on the run of the vessel, above the keel, and about ten feet forward from the rudder. The screw works transversely with the keel, radiating the water all round as it turns with a backward movement. Its diameter is five feet nine inches, and the length fore and aft about five feet. It almost appears incredible that so small a portion of machinery could propel a vessel of such length; but the hold it takes of the water, and the velocity with which it turns, are the elements of its power. It is quite under the surface, and is therefore invisible to spectators, either on board or on shore. It is worked by a spindle forming its axle, which runs fore and aft and is connected with the steam-engine, the velocity being acquired by a combination of spur-wheels and pinions. Each revolution of the larger wheel turned by the cranks of the engines gives, by the multiplied power, five and one-third revolutions of the screw, which consequently revolves at the rate of from one hundred and thirty to one hundred and fifty turns in a minute, according to the speed of the engine. In consequence of the powerful stream thus propelled against the rudder, the ship is actually found to obey the helm much more readily, and to be therefore more under command in steering, than either a common steam- or sailing-vessel; so that she can easily turn round in one and a quarter or one and a half of her own length, while it is well known that an ordinary steamer cannot do so with the paddles in less than six times her length. The shafts of the steam-engine work

fore and aft, the cranks turning transversely, so as to communicate the power directly, by cog-wheels, to the screw; and there is one considerable advantage arising from this arrangement of the machinery,—namely, that the cylinders, and in fact the whole weight of the engine, rests immediately over the keel, where the vessel is the least liable to straining or twisting from the effects of undue pressure. The larger wheel is toothed or cogged with horn-beam (timber).

"The action of the screw is different from the operation of 'sculling,' in the particular that in sculling there are but two motions, the chief force being derived from the lateral; whereas the screw exerts an equal degree of power for every part of its surface towards the periphery in the direction of the radii. The successive columns of water, as fast as presented, are forced away by the act of rotation, pretty much as the earth is turned away from the mold-board of a plow. The action of the screw may be said to bear the same relation to 'sculling' which the use of paddle-wheels does to the ordinary mode of propulsion by oars.

"The 'Archimedes' has made several trips and works well. Her speed is not quite so great as that of first-rate steamboats in calm weather, but this is believed to result from the fact that, her engines being on a new principle, and made by an inexperienced engineer, the full power of the boat is not developed. The nominal power of the engines is eighty horse-power, but in reality they do not work up to more than sixty.

"One of the greatest advantages of this invention, as applicable to all descriptions of shipping, is the circumstance that the screw may be thrown out of gear in two minutes and the vessel be put under sail alone. The screw is then turned by the motion of the vessel, but the drag is not more than half a mile in ten. Even the drag itself admits of being removed, as provision is made for totally unshipping the screw and bringing it upon deck.

"The advantages of the screw over paddle-wheels in ocean-steamers, it will be readily seen, must be very great. The leaning over of the ship often throws one of the paddle-wheels out of water and immerses the other too deeply. The screw is always in the water. The saving of fuel will be considerable, as the fires may be extinguished on board a ship propelled by the screw and the vessel used as a sailing-ship when the wind is full and fair. As a vessel of war the advantages would be palpable. This opinion has been expressed by officers of the royal navy who have witnessed the performance of the 'Archimedes.' When it is recollected that this invention is yet in its infancy, and that the 'Archimedes' is the first vessel on a large scale that has been constructed on the new principle, we may readily infer that the introduction of the screw in the construction of steamers is destined to work an important change in one of the most essential features of naval architecture."

Soon after this the "Archimedes" had to return to London, an accident having occurred to her boilers, and new boilers were fitted, which occupied five months. She was then sent to the Texel, by request of the Dutch government, whose interest her performances had excited; but on the way she broke the crank-shaft of one of her engines. She was consequently put into the hands of Messrs. Miller, Ravenhill & Co. for a complete repair, and at the same time the form of her screw was altered by dividing the one whole turn into two half turns, which, being placed on the opposite sides of the axis, gave to the propeller the character of a double-threaded screw of half a turn. In April, 1840, the Admiralty dispatched Captain Chappell, of the Royal Navy, and Mr. Lloyd, Chief Engineer of the Woolwich dockyard, to conduct a series of experiments upon the vessel at Dover. These experiments were carried on during April and May, and the speed of the "Archimedes" was tested relatively with that of the mail-packets on the Dover station. The result was a highly favorable report to the Admiralty, stating that the success of this new method of propulsion had been completely proven. Immediately after these experiments the vessel was placed at the disposal of Captain Chappell, who, accompanied by Mr. Smith, performed in her the circumnavigation of Great Britain, visiting every seaport of importance. Everywhere the vessel became an object of wonder and admiration. Heretofore engineers had been almost unanimous in opinion that a screw would occasion a loss of power from the obliquity of its action, and the consequent dispersion of the water, and concluded, therefore, that it would be ineligible as a propeller. But it was impossible for them to resist facts such as the performance of the "Archimedes" afforded.

The *London Nautical Magazine* took decided ground against the screw as a means of propulsion in the following article:

"PADDLE-WHEEL *versus* SCREW. *Trial of Strength.*—A few days ago the following experiment was made in the river to test the power of the Archimedean screw, as compared with the common paddle-wheel, in presence of Mr. Fawcet, the eminent steam-engine builder of Liverpool, Mr. Barnes, and other gentlemen. The 'Archimedes,' with Mr. Smith's screw propeller, and the 'William Gunston' tug-boat, with common paddles, were lashed together, stern to stern, with an interval between them of from twenty to thirty feet. The former vessel has two engines of twenty-five horse-power each; the latter, two of twenty.

"The 'Archimedes' was employed to tow the 'William Gunston' with her engines and paddle-wheels in a state of rest, and this she did with ease, the object of this preliminary trial being to ascertain that the working efficiency of the screw was not impaired by the relative position of the two vessels. The steam was then let on to the engines of the 'William Gunston,' and a fair trial of strength commenced between them. In a little while the 'Archimedes' was seen to

have lost all power over her rival; a minute or two more and the 'William Gunston' was tugging the 'Archimedes' after her in spite of the superior engine power employed on the opposite direction, and in spite also of the aid of her much-lauded screw propeller,—at first slowly, and as it were intermittingly, but at a constantly increased rate of speed, till at last it reached the usual tug-boat speed of from eight to nine knots per hour.

"So complete and convincing an experiment, as recorded in the above extract from the *Mechanic's Magazine*,[44] must indeed have been a most interesting sight, the result of which has fully confirmed our opinion of Mr. Smith's invention, as being one of those that are theoretically most ingenious, but in practice deficient. In the midst of the laudatory accounts of the doings of the 'Archimedes,' which followed her all round the coast, we briefly recorded our opinion among our 'Shakings,' and that too in spite of her beating an old government steamer at Liverpool. We ask, then, 'Where is the power of the "Archimedes" to contend with the ocean waves?' And 'echo answers, Where?' Let her keep to still water, and Mr. Smith's propeller will prove as good in practice as it has in theory. We understand it is being adopted on canals."[45]

After the "Archimedes" had accomplished the circumnavigation of Great Britain, she made a voyage to Oporto. This voyage was performed in sixty-eight and a half hours, and was at the time held to be the quickest on record. She also visited Antwerp and Amsterdam, passed through the North Holland Canal, and made a great number of trips to other places, leaving everywhere the impression that she had succeeded in demonstrating the practicability of propelling vessels by a screw in an efficient manner. She was next loaned to Mr. Brunel, who fitted her with screws of several different forms, and performed various experiments with her at Bristol. The result of his experiments was so satisfactory that the "Great Britain," originally intended to be propelled by paddles, was altered and adapted for the reception of a screw.

Meanwhile, the Admiralty determined upon adopting the screw for the navy, and in the merchant service an opinion had arisen equally favorable to its eligibility.

In 1840 and 1841 the "Princess Royal" was built at New Castle, the "Margaret" and "Senator" were built at Hull, and the "Great Northern," a vessel of fifteen hundred tons burden, was laid down at Londonderry, in Ireland. These were merchant screw vessels. In 1841 the "Rattler," the first screw vessel built for the British navy, was laid down at Sheerness. This vessel, of eight hundred and eighty-eight tons burden, was launched in the spring of 1843. The "Rattler" was

[44] Vol. xxxii. p. 149, No. 885, for July.

[45] *London Nautical Magazine*, September, 1840.

fitted with a screw in every respect the counterpart of the screw of the "Archimedes,"—viz., a double-threaded screw of half a convolution. The length of the screw was subsequently reduced, and it was found that best results were obtained with a length of screw answering to one-sixth of a convolution. In the years 1843, 1844, and 1845 an extensive series of experiments were made on the "Rattler" upon screws of various forms, and under varying circumstances of wind and water. The performance of the vessel was so satisfactory that the Lords of the Admiralty ordered twenty vessels to be fitted with the screw, under Mr. Smith's superintendence. The screws introduced into these vessels in every case were double-threaded screws, set in the deadwood, after the fashion adopted in the "Archimedes" and the "Rattler."

Such are the respective merits of Smith and Ericsson in connection with the practical introduction of the screw propeller. Ericsson had the advantage in mechanical capacity, and Smith in persistency of character. Ericsson, previous to his connection with the screw, was an accomplished engineer. Smith was only an amateur, with everything except the leading idea to learn. Ericsson's mechanical resources gave him means of overcoming difficulties which Smith did not possess; and Smith had to accept expedients then usual among engineers as his starting point, while Ericsson could reject those expedients in favor of others which his own ingenuity suggested. In bringing up the speed of his screw, Smith had to use gearing, as that was the expedient which was approved by orthodox engineers; but Ericsson, throwing the dogmas of the engineers to the winds, coupled the engine immediately to the propeller. This comparative destitution of mechanical resources must have added to the difficulties of Smith. But his steady and resolute perseverance rose superior to all impediments, and the lead he took at the outset he maintained throughout. Smith's patent was taken out on the 31st May, 1836; Ericsson's patent was taken out on the 13th July, 1836. The first trial of Smith's experimental boat was the 31st May, 1836, and the first trial of Ericsson's experimental boat was on the 30th April, 1837. In the summer of 1837, Ericsson exhibited his vessel to the Lords of the Admiralty, but without result, owing, as is alleged, to the anticipated difficulty of steering. In September, 1837, Smith carried his vessel to sea, and showed, by repeated experiment, that the objection entertained to Ericsson's plan did not exist in his. Ericsson's vessel appears to have been more efficient than Smith's. Its engine power was greater, and the mechanical details of its construction more perfect. But Smith's vessel was also completely successful. She towed the "British Queen" steamer in the river, and also the "Lord William Bentinck," a heavily-laden ship, at a speed of two and a half miles an hour, although there was an opposing breeze. Both vessels were therefore successful.

1837.—On the 18th of February, 1837, six steamers launched by the Austrian government commenced running between Perth and the ports of Lower Hungary. This step was hailed in Germany as an important inception of the entire navigation of the Danube by the Austrian government.

Of the steam-packets which were to run between Marseilles and Constantinople, and between Marseilles and Alexandria, seven vessels were this year assembled at Toulon. The "Scamandre" was the first vessel to start for Constantinople. She left during the month of April. A Russian steamer left Constantinople for Odessa on the 20th of each month; fare, twenty-two dollars. An English steamer was running from Constantinople to Trebizond at the beginning and middle of each month, the distance being five hundred and thirty miles. An Austrian steamer, however, placed on that station in May, 1837, made the passage once a week.

The steamer "Maria Dorothea" left Constantinople for Smyrna every Monday, and made the voyage in thirty-six hours. An English steamer, the "Crescent," made the same passage in thirty hours. The Levant steamer, which had hitherto run between Smyrna and Athens twice a week, made the voyage in about forty-eight hours. The Ionian steamers left Corfu for Zante twice a month, the voyage being made in about fourteen hours. The English steamer left Corfu the 29th of each month, touched at Patras to take the mail, and thence proceeded to Malta, touching at Zante, and on to Falmouth, making the voyage of nineteen hundred miles in about twenty days.

Upper cabins in steamers on the great American lakes were first introduced in 1837, on board the steamer "Great Western," by Captain Augustus Walker, who died at Buffalo, New York, 1865, aged sixty-five years.

1837.—In 1837 attention was drawn to the subject of steam navigation across the Atlantic, and the *Edinburgh Review*, in a long article on the subject, which was attributed to Dr. Lardner, maintained that until further improvements should be made in the construction and management of steam-vessels, or the economy of fuel, it would be *impossible*, as an ordinary thing, to make a continuous voyage from New York to Liverpool, and especially from Liverpool to New York. The New York *Journal of Commerce*, in June, 1837, referring to this article, approved of its conclusions, and supported them in a long article, concluding, "Whatever difference of opinion may exist as to the practicability of an Atlantic steam voyage, it must be admitted upon all hands that its extent, for an uninterrupted run, comes to the extreme verge of the possible powers of steam navigation." "To be successful the nearest points of approach to the Eastern and Western continents should be chosen

as the points of arrival and departure, to increase the probabilities of success."[46]

The *London Nautical Magazine* for March, 1837,[47] says, "The time is fast approaching when the famous prophecy of the Rev. Dr. Dionysius Lardner, delivered in Dublin and redelivered in Bristol, 'that it is as easy to go to the moon as to go direct from a port in England to New York,' will be tested. There are two vessels at present building to run direct from Bristol and London to New York. The Great Western Steamship Company is building a vessel at Bristol, which will probably make her first trip next August. She is intended to carry twenty-five days' coal. The British and American Steam Navigation Company, of London, have contracted for a vessel of seventeen hundred and ninety-five tons. This, the largest steam vessel ever yet propelled, will have a capacity for twenty-five days' fuel, eight hundred tons measurement goods, and five hundred passengers. We sincerely wish both the Bristol vessel and the London one all manner of success; and when we reflect that sixty thousand people have landed at New York from January 1 to September 1, and twenty-seven thousand in Quebec last year, the increase that will naturally take place when the passage is shortened to *fifteen* days instead of *thirty-seven*, the present outward average of the New York packet ships, we do not think that any of the numerous plans before the public hold out stronger inducements to the capitalists.

"It is difficult to calculate the natural benefits that will accrue to both countries by the establishment of steam communication between them. This much we may affirm, it will greatly improve both countries and render perpetual the peace that now happily exists between them."

1838.—A letter prepared by the Secretary of the Treasury of the United States, in answer to a resolution of inquiry of the House of Representatives, 20th of June, 1838, communicates many interesting particulars as to the employment of steam-vessels in the United States, and the accidents that had happened to them:

"The number of accidents occasioning loss of life or much injury to property, in the use of steam-engines of every kind in the United States, is computed to have been about 260. Of these, 253 are ascertained, and the rest are estimated. Such accidents, by explosions and other disasters to steamboats, appear to have constituted a great portion of the whole, and are supposed to have equaled 230, of which 215 are ascertained. The first of these is believed to have occurred in the 'Washington,' on the Ohio River, in 1816.

"Since the employment of steamboats in the United States it is

[46] See *Army and Navy Chronicle*, June 29, 1837, for the *Journal of Commerce* articles and several others.

[47] See also *Army and Navy Chronicle* for April 13, 1837.

computed that quite 1300 have been built here. Of these, about 260 have been lost by various accidents, as many as 240 worn out, and the rest are now running.

"The largest boat in the United States is supposed to be the 'Natchez,' of 860 tons, and near 300 horse-power, designed to run between New York and Mississippi. The 'Illinois' and the 'Mattison,' on Lake Erie, are next in size, the former being 755 and the latter 700 tons. The 'Massachusetts,' on Long Island Sound, is the next largest, being 626 tons, and the 'Buffalo,' on Lake Erie, next, being 613 tons.

"The largest boats passing Louisville in 1837 were the 'Uncle Sam,' of 490 tons, and the 'Mogul,' of 414 tons; though below Louisville the 'Mediterranean,' of 490 tons, and 'North America,' of 445 tons, on the Ohio, and the 'St. Louis,' of 550 tons, on the Mississippi, are running.

"The whole number of steamboats ascertained and estimated to be now in this country is 800. In England, in 1836, the whole number is computed to have been 600. On the Western and Southwestern waters alone near 400 are now supposed to be running, where none were used till 1811, and where, in 1834, the number was computed to be only 234. On the Ohio River, in 1837, 413 different steamboats are reported to have passed through the Louisville and Portland Canal, besides all below and above, which never passed through. It deserves notice that of those 413 near 60 went out of use by accidents, decay, etc., within that year; and 104 of the others were new, and many of them were probably destined to run on other rivers. In illustration of the rapid increase of steamboat business on the Ohio, the number of steamboat passages through the Louisville Canal increased from 406, in 1831, to 1501, in 1837, or nearly fourfold in six years. Seventy boats are running the present year on the Northwestern lakes, where a few years since the number was very small, having been as late as 1835 only twenty-five. Of the 800 steamboats now in the United States, the greatest number ascertained to be in any State is 140, in the State of New York.

"The tonnage of all the steamboats in the United States is computed to exceed 155,473. Of this, 137,473 is in boats ascertained or reported. By the official returns, the whole tonnage would now, probably, equal near 160,000 tons, having been equal, in 1837, to 153,660. Many boats included in those returns have been lost or worn out, and several new ones have been built since.

"The tonnage of each boat here averages about 200, and the estimates, where the returns have been defective, were made on that basis. In England the tonnage is estimated to have been 67,969 in 1836.

"The greatest loss of life on any one occasion in a steamboat appears to have been by collision, and the consequent sinking of the 'Monmouth,' in 1837, on the Mississippi, by which 300 lives were lost.

The next greatest were by the explosions of the 'Oronoka,' in 1838, on the same river, by which 130 or more lives were lost; and of the 'Moselle,' at Cincinnati, Ohio, by which 100 to 120 persons were destroyed. The greatest injury to life by accidents to boats from snags and sawyers appear to have been 13 lost, in 1834, on the 'St. Louis,' on the Mississippi River. The greatest by shipwreck was in the 'Home,' in 1837, on the coast of North Carolina, when one hundred persons were lost. The greatest by fire happened in the 'Ben Sherrod,' on the Mississippi River, in 1837, when near 130 perished. The number of steamboats built in the United States in 1834 was 88; in 1837 it was 184, having increased over 200 per cent. in three years. The greatest number of steamboats and other steam-machines appear to have been constructed at Pittsburgh, Cincinnati, and Louisville, on the Western waters, and New York, Philadelphia, and Baltimore, on the Atlantic. At Louisville alone, from 1819 to 1838, there was built 244 steam-engines, 62 of which were for boats. The fuel originally used in steamboats in the United States was wood; of late years bituminous coal has been substituted in many instances, also anthracite coal. The latter, from the small space it occupies, seems to possess a decided advantage for sea-going vessels, as well as locomotives.

"Some steamboats made of iron are believed to be in use in Georgia, if not in other parts of this country, though none of that material have been manufactured here; it is computed that their cost is less than those of wood, and, as they draw less water with the same freight, they are more useful on shallow streams."—*Sup.*

The number of steamboats built in the United States during the years ending on the 30th of September, 1838 and 1839, were 90 and 125 respectively.

It has been frequently said, and is generally believed, that Dr. Dionysius Lardner publicly asserted, before the voyages of the "Great Western" and "Sirius" were accomplished facts, that a steam voyage across the Atlantic was a physical impossibility. What he did say was, however, quite different, viz.: that such vessels could not be made a paying investment for such a voyage without government assistance or a subsidy, in the then state of steam navigation.

He says,[48] "It cannot be seriously imagined that any one who had been conversant with the past history of steam navigation could entertain the least doubt of the abstract practicability of a steam vessel making the voyage between Bristol and New York.

"A vessel having as a cargo a couple of hundred tons of coals would, *cæteris paribus*, be as capable of crossing the Atlantic as a vessel transporting the same weight of any other cargo. A steamer of the usual form and construction would, it is true, labor under comparative disadvantages, owing to obstructions presented by her paddle-wheels and

[48] Museum of Science and Arts, vol. x., 1856.

paddle-boxes; but still it would have been preposterous to suppose that these improvements could have rendered her passage to New York impracticable. But, independently of these considerations, it was a well-known fact that long antecedent to the epoch adverted to, the Atlantic had actually been crossed by the steamers 'Savannah' and 'Curaçoa.' . . . Projects had been started, in 1836, by two different and opposing interests, one advocating the establishment of a line of steamers to ply between the west coast of Ireland and Boston, touching at Halifax, and the other a direct line making an uninterrupted trip between Bristol and New York. In the year 1836, in Dublin, I advocated the former of these projects, and in 1837, at Bristol, at the next meeting of the British Association, I again urged its advantages, and by comparison discouraged the project of a direct line between Bristol and New York. When I say that I advocated one of these projects it is needless to add that the popular rumor that I had pronounced the Atlantic voyage by steam impracticable is utterly destitute of foundation."

The meeting took place August 25, 1837, and the report of the *Times's* special reporter which appeared in that paper on the 27th says, "Dr. Lardner said he would beg any one, and more especially of those who had a direct interest in the inquiry, to dismiss from their minds all previously-formed judgments about it, *and more especially upon this question* to be *guarded against the conclusions of mere theory;* for if ever there was one point in practice of a commercial nature which more than another required to be founded on experience, it was this one of extending steam navigation to voyages of extraordinary length. He was aware that, since the question had arisen, it had been stated that his own opinion was averse to it. *This statement was totally wrong;* but he did feel that great caution should be used in the means of carrying the project into effect. Almost all depended on the first attempt, for a failure would much retard the ultimate consummation of the project.

"Mr. Scott Russell said that he had listened with great delight to the lucid and logical observations they had just heard. He would add one word. Let them try this experiment with a view only to the enterprise itself, but on no account try any new boiler or other experiment, but have a combination of the most approved plans that had yet been adopted.

"After some observations from Messrs. Brunel and Field, Dr. Lardner, in reply, said *that he considered the voyage practicable,* but he wished to point out that which would *remove the possibility of a doubt,* because if the first attempt failed it would cast a damp upon the enterprise and prevent a repetition of the attempt."

"What I did affirm in 1836–7," continues Dr. Lardner, "was that the long sea voyages by steam which were contemplated could not at that time be maintained with that regularity and certainty which are indispensable to commercial success by any revenue which could be expected

from the traffic alone, and that without a government subsidy of a considerable amount such lines of steamers, although they might be started, could not be permanently maintained."

He then proceeds to show, up to 1851, the commercially non-success of transatlantic steamers that were not subsidied, and adds,—

"Thus it appears, in fine, that after a lapse of nearly fourteen years, notwithstanding the great improvements in steam navigation, the project advanced at Bristol, and there pronounced by me to be commercially impracticable, signally failed."

It is a pity he could not have looked a little farther into the future and seen the commercial success of later steamships, consequent upon their increase of size and the economical improvements adopted, as also from the demand for the agricultural products of the United States furnishing return cargoes.

Sir John Ross, R.N., the distinguished Arctic voyager, in his "Treatise on Navigation by Steam," published in 1837, says, "The ships and vessels proper in steam navigation will admit of a still greater variety than sailing-vessels; and although none have as yet been constructed of a greater tonnage than one thousand tons, there is no good reason why they may not be twice as large or of as much tonnage as the largest ship in the navy; for although there may be a limit to the size of the boiler, shaft, and other parts of the machinery, there can be no objection to two sets if the ship is too large for one." He then proceeds to say, "There can be no doubt that in a future war a fleet of men-of-war, and indeed a small squadron, will scarcely be effective without a considerable if not an equal number of steam vessels to act under various circumstances; and, among other things, their province will be to tow or increase the velocity of the ships in calms or light winds, and particularly in action." Such vessels, he adds, should have the parts containing the machinery fortified against shot at distances where it would take effect upon her consort; and he also proposes a class of steam gunboats for coast defense, having their guns and paddles covered by a *semicircular shield-deck of iron;* he gives sectional illustrations of this proposed defense.

He says also in the same volume, "It is believed by those who have not devoted much time and attention to the subject of steam navigation that it cannot be extended to perform foreign voyages, and it must be confessed that the experiments which have been made seem rather to confirm than to alter that opinion; but it will be shown here that the trials which have hitherto been made have not been of such a nature as to justify a decided opinion." He also gives in the volume, illustrated by diagrams, a system of naval tactics, in which the steam vessels are represented either as towing ships of the line on the off-side, or as whippers-in of a convoy in time of war.

In 1837 Mr. Samuel Hall, of Basford, the inventor of the tubular

condenser, patented a wheel having its floats placed obliquely, but so arranged that every three of them were set in an opposite direction; and about the middle of 1838 a patent for another oblique paddle-wheel was taken out by Lieutenant W. S. Hall, of the Eighteenth Regiment. These and other inventions for the improvement of the paddle-wheel preceded the invention of the Archimedean propeller, improperly called the Archimedean screw, being only a small segment of a screw, and resembling more a short fan than a screw. The system was taken from a kind of small windmills called "water-snakes" employed in low countries like Holland to draw water off the plains.

1837.—THE GERM OF THE UNITED STATES STEAM NAVY.

Previous to 1837 the United States steam battery "Demologos," or "Fulton 1st," had been launched in 1815; and the steam galliot "Sea-Gull" was employed in Porter's mosquito fleet for the suppression of piracy in the West Indies. But "Fulton 2d," launched in 1837, was the pioneer steam war-vessel of our present naval organization.

October 31, 1837.—The Secretary of the Navy authorized Captain M. C. Perry "to appoint two first-class and two second-class assistant engineers; the appointments to be confirmed by the commandant of the station." "The engineers must receive from you," he adds, "a letter of appointment revocable at any time by the commanding officer of the station, upon complaint of intemperance, incapacity, insubordination, negligence, or other misconduct, preferred by the commander of the steamer, if proved to the satisfaction of the commanding officer of the station. The commander of the steamer, of course, to have the power of suspending them from duty if necessary. The engineers must be required to sign some proper instrument of writing which will legally make them liable to this law for the government of the navy, but to be exempt from corporal punishment, which instrument is to be transmitted to the Secretary of the Navy, with their letters accepting their appointments."

November 7, 1837.—The Secretary wrote Captain Perry that the "Fulton," as recommended by the Commissioners of the Navy and approved by the Navy Department, was allowed—two first-class engineers, at $800 per annum each; two second-class engineers, at $500 per annum each; four coal-heavers, at $15 per month; and eight firemen, at $25 to $30 per month.

Both the firemen and coal-heavers were to sign the ship's articles, and were to be removable "at the pleasure of the commander of the vessel," as authorized for the reduction of petty officers and seamen. "If additional coal-heavers should be found necessary, some of the seamen or ordinary seamen of the vessel might be designated by the commander to perform that duty." He next wrote:

"NAVY DEPARTMENT, November 21, 1837.

"CAPT. M. C. PERRY, Com'dg Str. 'Fulton,' New York:

"SIR,—Your letter of the 16th instant, relative to the engineers of the 'Fulton' and their uniforms, has been received.

"*The adoption of a uniform* such as you may approve, *if agreeable to those at whose expense it is to be provided*, meets with the sanction of the Department, and it is also desirable, as mentioned in your letter, that none be appointed engineers but those of the very best standing.

"I am, respectfully, &c.,

"M. DICKENSON,
"*Secretary of the Navy.*"

A letter dated December 19, 1837, authorized Captain Perry to employ, agreeably to his request, four additional firemen.

December 21, 1837, the Secretary wrote him: "Your communication of the 17th instant has been received, with its several inclosures, and the appointments of assistant engineers which you have made, as well as the measures you have taken in regard to the engagements, etc., of the engineers, firemen, and others, of the steamer 'Fulton,' are approved by the Department."

February 13, 1838, the Secretary wrote Captain Perry that he approved of his suggestion, and says, "I have directed Commodore Ridgeley to place on board the 'Fulton' five *apprentices* to the navy, who are to be under the particular charge of the engineers (one to each) and exclusively attached to the engineers, and to be shipped and paid as other apprentices."

February 21, 1839, the Secretary authorized the pay of the second assistant engineers on the "Fulton" to be increased from five hundred to six hundred dollars from the 1st of March.

March 1, 1839, he authorized "the salary of such engineers as now receive eight hundred dollars to be increased to nine hundred."

In this connection it is interesting to note the rapid rise in importance of our steam navy in the past forty-one or forty-two years. Its *personnel* in 1881 consists of:

10 chief engineers on the active list ranking relatively with captains in the navy, one of whom, as Chief Engineer of the Bureau of Steam Engineering, has the relative rank of commodore; 15 chief engineers with the relative rank of commander; 45 chief engineers with the relative rank of lieutenant-commander; 89 passed assistant engineers with the relative rank of lieutenant; 10 passed assistant engineers with the relative rank of master; 37 assistant engineers with the relative rank of ensign; 53 cadet engineers, graduates; 103 cadet engineers at the Naval Academy,—viz., 25 first-class; 26 second-class; 26 third-class; 26 fourth-class.

1 chief engineer on the retired list, with the relative rank of captain;

1 chief engineer with the relative rank of commander; 6 chief engineers with the relative rank of lieutenant-commander; 18 passed assistant engineers with the relative rank of lieutenant; 25 assistant engineers with the relative rank of master.

While the rank of engineer officers has been increased, the pay has similarly advanced. The engineer-in-chief now receives $5000; chief engineers, from $4400 to $2800, on duty; passed assistant engineers, from $2200 to $2000, on duty; assistant engineers, from $1900 to $1700, on duty; cadet engineers, from $1000 to $500, on duty; and their right to leave pay has been recognized. When retired they receive three-fourths of their highest pay on the active list.

1838.—In 1836 the startling project was announced that it was in contemplation to supersede the far-famed New York and Liverpool packet-ships by an establishment of steamships which would sustain constant, regular, and rapid communication between the New and the Old World. They were to be the channel for commerce, intelligence, and social intercourse between the metropolis of the West and the marts of the United Kingdom; they were to fulfill all the functions which for half a century had been so admirably discharged by the sailing packet-ships, but with expedition increased in a threefold proportion.

Daniel Webster, in a lecture at Boston, said, in allusion to steam-power, "In comparison with the past, what centuries of improvement has this single agent comprised in the short space of fifty years! . . . What further improvements may still be made in the use of this astonishing power, it is impossible to know, and it were vain to conjecture. What we do know is, that it has most essentially altered the face of affairs, and that no visible limit yet appears beyond which its progress is seen to be impossible." When Webster spoke thus, the grand problem of ocean steam-navigation had not been solved; in fact, the possibility of a steamship crossing any *ocean* was generally denied both by practical and scientific men.

The keel of the "Great Western" was laid, and assurance given that she would be followed by a splendid line of vessels, which would consign the packet-ships to the care of the historian as "things that were."

The project was simultaneously started by two different opposing interests, one advocating a line of steamers to ply between the west coast of Ireland and Boston, touching at Halifax, the other a direct line making an uninterrupted trip between Bristol and New York. The former, the "British and American Steam Navigation Company," resolving not to be left astern by the company in Bristol, which was getting the "Great Western" ready for sea, chartered the "Sirius," a steamer which had been built to run between London and Cork, to run against the "Great Western," and she made two voyages in their employ.

The "Sirius" arrived at New York on St. George's day, the 23d of April, also the anniversary of the birth and death of Shakspeare. The New York papers of that date say, "Myriads of persons crowded the Battery to have a glimpse of the first steam vessel which had crossed the Atlantic from the British Isles and arrived safely in port." The "Sirius," of seven hundred tons' register and engines of three hundred and twenty horse-power, sailed from Cork at ten A.M. Wednesday, April 4, 1838, and was followed by the "Great Western," which sailed from Bristol (the port which sent out the Cabots), April 8, both vessels arriving at New York April 23, 1838, the "Sirius" a few hours in advance of the "Great Western."

The following account of these pioneer steamships, and of their voyage across the Atlantic, is taken from the *New York Express* of April 24, 1838.[49]

[49] The *New York Courier and Enquirer* of April 23, 1838, has this notice of the arrival of the "Sirius:"

"ARRIVAL OF A STEAMER FROM EUROPE.

"*Seven days later from London. Six days later from Liverpool.*

"Last night our news schooner 'Eclipse' boarded the steamer 'Sirius,' Lieutenant Richard Roberts, R.N., Commander, from Cork, whence she sailed on the 4th inst. She has performed the voyage without accident, save a slight one which befell her on coming in the Hook, where she grounded. Since her departure she has used only fresh water in her boilers, having on board Mr. Hall's condensing apparatus."

Under the head of marine news is reported: "Steam packet 'Sirius,' Roberts, from Cork, sailed April 4, with forty-six passengers, etc., to Wadsworth & Smith. The 'Sirius' went ashore on the point of the Hook last evening about ten o'clock. She did not sustain any damage, and will be got off on the rising tide."

The same paper contains the following advertisement:

"BRITISH STEAM-PACKET SHIP FOR LONDON, TO SAIL FROM NEW YORK, MAY 1, 1838.

The new and powerful Steamship

SIRIUS,

700 tons burthen and 320 Horse-power,

LIEUTENANT R. ROBERTS, *Commander*,

is intended to sail from London, March 28th, touching at Cork, and thence, on the 2d of April, for this port, returning from New York to London on the 1st of May.

"This vessel has superior accommodation, and is fitted with separate cabins, for the accommodation of families, to whom every possible attention will be given.

"Cabin, $140, including provisions, wines, etc.

"Second cabin, $80, including provisions.

"This superior steamship has been chartered by the Directors of the British and American Steam Navigation Company of London, to meet the pressing demands of the public, in anticipation of the steamship 'British Queen,' now building, is a new vessel, about six months old, and has proved herself superior to any steam vessel in British waters in speed and seaworthy qualities.

"Further information afforded on application; and for freight and passage apply to

WADSWORTH & SMITH,
4 Jones Lane (rear 103 Front Street),
Agent of the British and American Steam Navigation Company."

The following is the first advertisement of the "Great Western" in the New York *Courier and Enquirer*, April 24, 1838:

"STEAMSHIPS 'SIRIUS' AND 'GREAT WESTERN.'—SPLENDID SIGHT FROM THE BATTERY.

"Yesterday was a day of unusual joy and excitement in this city, it being almost universally considered as the beginning of a new era in the history of Atlantic navigation. The steamship 'Sirius' having arrived Sunday night, thousands assembled to see her, as soon as the news spread about the city. She was anchored a short distance from the Castle, and the crowds upon the Battery had a fair view of her from that promenade. The sun shone with unusual clearness, and the weather was as fine as could be wished.

"The 'Sirius' sailed from Cork on the evening of the 4th instant, and made the Highlands of New York at six o'clock P.M. on the 22d, thus making the passage in eighteen days; having on board forty-seven passengers. During the day her sides were thronged by small boats filled with passengers to view this fine vessel from the Old World. About one o'clock it was announced by telegraph that the steamer 'Great Western' was off the Hook, when additional thousands poured down Broadway; and the Battery at two P.M. presented a most brilliant appearance. The crowd reminded one of the landing of the 'Nation's guest,' Lafayette. The smoke of the 'Great Western' was seen in the horizon ascending in black volumes long before her hull was visible. The ship, however, soon came in sight, and, as she passed Bedlow's Island, received a salute from the fort of twenty-six guns. She approached the Battery through a fleet of row-boats and small craft, and was cheered by every one. She soon ranged alongside the Castle, sailed around the 'Sirius,' which gave her a salute, and the crowd from the wharves, Castle, boats, etc., gave her three hearty cheers, which was returned by those on board. She then pursued her course up the East River, and anchored near Pike Street. This successful experiment, and this new era of steam packets between this port and England, gave life and joy to all.

"The 'Great Western' left Kingroad, Bristol, at two o'clock, April

"BRITISH STEAM-PACKET SHIP
"GREAT WESTERN,
"JAMES HOSKINS, R.N., Commander.

"Having arrived yesterday from Bristol, which place she left on the 8th inst., at noon, will sail from New York for Bristol on Monday, 7th May, at 2 o'clock P.M.

"She takes no steerage passengers. Rates in the Cabin, including Wines and Provisions of every kind, 30 guineas; a whole state-room for one person, 50 guineas. Steward's fee for each passenger, £1 10s. sterling. Children under 13 years of age half price. No charge for letters or papers. The captain and owners will not be liable for any package unless a bill of lading has been given for it. One to two hundred tons can be taken at the lowest current rates.

"Passage or freight may be engaged, a plan of the cabin may be seen, and further particulars learned, by applying to

"RICHARD IRVING, 98 Front Street."

The "Great Western" continued to sail from the Severn, and subsequently from the Mersey, and made seventy-four transatlantic passages before passing into the hands of the West India Company. On her second trip from New York she reached Bristol in twelve and a half days.

7th, and here she was at two o'clock April 23d, in only sixteen days,—thus bringing England nearer to us than many parts of our own country. This has been done in a season of the year, not of summer sunshine, but of gales, storms, sleet, and hail,—and steam navigation across the Atlantic is no longer an experiment, but a plain matter of fact. The thing has been done triumphantly.

"The 'Great Western' steamship was built at Bristol, by the Great Western Steamship Company, and is intended to commence a regular line between Bristol and New York. She was launched on the 19th of July, 1837. Her length between the perpendiculars, from the forepart of the stem to the afterpart of the stern at the keel, 212 feet; length of keel on the blocks, 205 feet; length of cabin deck (saloon), 75 feet; length over all (from figure-head to taffrail), 235 feet; breadth between paddle-wheels, 34 feet 4 inches; depth under deck to the top of floors, 23 feet 3 inches; scantling floors on the side of keel, 15 inches, sided; ditto, 16 inches, moulded; length of floors, 24 feet; thickness of bends, 7 inches; bottom plank, 5 inches; top sides, 4 inches; sheer streaks, 5 inches; upper deck clamps, 8 inches; diagonal riders, 5 inches, 3 feet apart; iron diagonals, 4 inches by $\frac{3}{4}$; bilge planks, 6 inches; keelson, 20 by 21 inches.

"Tonnage, 1320 tons; best berths, 150; berths for crew, 26; do. for engineers, firemen, and officers, 40; two engines, by Maudsley & Field, 400 horse-power, 200 each; diameter of cylinder, 73½ inches; length of stroke, 7 feet; coal stowage, 600 tons, or enough for thirty tons per diem for twenty days.

"The whole cost of this splendid ship amounts to about £50,000, £21,373 15*s.* 10*d.* of which has been expended for ship-building, £13,500 for the engines, about £1000 for the fitting up, furniture, and painting of the grand saloon, and the remainder for rigging, equipment, stores, and coals.

"The 'Sirius' is a beautiful model, seven hundred tons, three hundred and twenty horse-power, schooner-rigged. Notwithstanding she had very rough weather, she came over with perfect safety. Passengers are delighted with her performance. Her boilers were supplied the whole way with fresh water by a distilling apparatus which converted the salt into fresh water. The distilling worms (small copper tubes) measure, as is reported to us, near *four miles!*

"The following is the journal of her voyage:

"4th April.—Started; light breezes from N.E. Draft of water, 15 feet 2 inches.

"5th.—Heavy at N.E. to N.N.E., windy; fresh gale, much head-sea, slight rain. Exchanged numbers with the bark 'Dale,' of Liverpool. Weighted one ton of coal, which lasted 1 h. 30 m.; pressure on the boilers, 53.4 pounds.

"6th.—Stormy, W.N.W. breezes, with squalls and heavy head-sea. Passed two brigs, one standing east, and the other north.

"7th.—Same, strong gales, and squally, with rain,—vessel laboring heavy. Passed two large ships standing to the eastward, under double-reefed topsails. Very squally. Passed a barque. Heavy sea, with long swell; took in water on deck.

"8th.—Same, with hazy weather. Stopped engine, owing to one of the braces working loose—started the engine in an hour after—heavy rains.

"9th.—Wind still W.N.W., and a heavy head-sea—clear. Passed a brig standing east. Set a single-reefed foresail, and double-reefed mainsail.

"10th.—Spoke ship 'Star,' of New York, longitude 24 W.—fresh gales and squally—shipped a great deal of water.

"11th.—Winds E.N.E.—passed a ship standing to the south—light breezes.

"12th.—Light winds, easterly—stopped engine to pack the stuffing-boxes—light winds and fair.

"13th.—S.E., light breezes. Spoke the 'Roger Sherman,' of Bath, 36 days from New Orleans, bound to Havre—hoisted colors to a Falmouth packet—three sail in sight—reduced the weight to 33.4 lbs. on boilers.

"14th.—S.W. light breezes—passed a ship standing to the westward—observed a change in the color of the water.

"15th.—Heavy W.N.W. gale; dark and foggy.

"16th.—N.W. to W. gales; heavy head-sea and snow—vessel laboring—stopped engine three-quarters of an hour to fasten screws.

"17th.—N.W. by W. winds; squally, with hail and snow.

"18th.—S.W. winds and squalls.

"19th.—Same.

"20th.—W. by N., heavy sea and hard rain—stopped engine, and was boarded by Her Majesty's ship Coromandel, from Bermuda, bound to Halifax, with Eleventh Regiment.

"21st.—Ditto—exchanged signals with an Austrian brig.

"22d.—Made light for the pilot off the Highlands. Not getting a pilot, the 'Sirius' ran in, and then touched off the Hook—receiving, however, no damage."

The following letter from Her Majesty's Consul, addressed to the commander of the "Sirius," historically records the event of her arrival:

"HER MAJESTY'S CONSULATE,
"NEW YORK, April 23, 1838.

"SIR,—I have the honor and happiness to congratulate you on the arrival of your steamship across the Atlantic, at a season when strong gales so generally prevail, thereby having proved that British skill

has accomplished a most important enterprise, which will produce a revolution in commercial and social intercourse, of which we are incapable of forming any just conceptions. Permit me, sir, to add that I have, in common with my fellow-subjects of Her Majesty in this city, a further cause of rejoicing, that the honor of accomplishing the enterprise has been achieved by a son of the British navy, and that it was completed on St. George's day.

"I have the honor to be, sir,
"Your humble servant,
"JAMES BUCHANAN.

"RICHARD ROBERTS, Esq., R.N.,
"Commander of the Steamship 'Sirius.'"

"LOG OF THE 'GREAT WESTERN.'—We published yesterday an abstract from the log-book of the 'Sirius,' showing her daily progress, and the sort of weather she had to encounter, and we now give an extract from the log-book of the 'Great Western':

Dates.	Course.	Distance.	LATITUDE.		LONGITUDE.		Wind.	REMARKS ON WEATHER.
			Acct.	Obs.	Acct.	Chron.		
April 8...	10 P.M.	.....	Sandy I.				N.W. N.N.W.	Strong gale.
" 9...	West.	240		50.27		07.32	N.N.W. and S.W.	Moderate.
" 10...	78-30 W.	213	49.55	00.00	12.50	12.16.45	W. by N. and S.W.	Moderate.
" 11...	W. by S.	206	49.04	43.11	17.25	17.10	S.W. and E. by S.	Moderate and hazy, rough at night.
" 12...	W. 1-2 S.	231	47.47	47.17	22.48	22.05.10	E. by S.E. to S.E.	Moderate and cloudy.
" 13...	W. 1-4 S.	218	46.56	46.56	23.09	28.27	E.S.E.	Light winds.
" 14...	W. 3-4 S.	218	46.26	46.23	33.40	34.09	S.W. and S.S.W.	At 10 P.M., squally, with small rain.
" 15...	W. by S.	241	45.24	45.19	39.43	39.38.30	S.E. to S.W. by S.	Strong and squally, vessel lurched deeply but easy.
" 16...	W. 3-4 S.	243	44.46	44.34	45.19	45.31	Variable.	Squally.
" 17...	W. 3-4 S.	185	44.07	44.10	49.46	49.21	S.W. to W.N.W.	Strong gales and heavy sea.
" 18...	W.S.W.	169	42.02	42.58	52.55	52.30	W.N.W. to W. by N.	Moderate.
" 19...	W. 1-4 S.	206	42.02	42.02	56.50	56.49.45	S.W.	Strong winds and heavy sea.
" 20...	W. 3-4 S.	183	41.36	No ob.	60.54	No. ob.	S.W. W.N.W.	Strong winds and heavy sea, ship very easy.
" 21...	W. 3-4 S.	192	41.05	40.30	65.05	64.24.13	N.N.W.	Light winds and cloudy.
" 22...	S. 83 W.	198	39.48	39.41	68.38	69.03.30	N.N.W. to W.N.W.	Strong winds and frosty.
" 23...	S. 79 W.	230					N.N.W. and N.	Fine weather; at 10 received a pilot.

To harbor, 50; 3223 miles steaming.

A passenger on the "Great Western," on this her first transatlantic voyage, in a communication to *Chambers' Edinburgh Journal*, says,—

"A number of daring passengers—for daring they were thought in that day—took berths for the voyage in the 'Great Western'; and on 8th April, 1838, at noon, the gallant ship steamed away from her anchorage at the mouth of the river Avon, and majestically descended the Severn, bound for New York. One of her passengers says, when they were fairly under way, 'Whatever misgivings might previously have assailed us in the contemplation of our voyage, I believe that at this

moment there was not a faltering heart among us. Such stability, such power, such provision against every probable or barely possible contingency, and such order presented itself everywhere on board, as was sufficient to allay all fear.'

"Suffice it that the 'Great Western' entered the harbor of New York at full speed on the afternoon of 23d April, having performed the passage in the then unprecedentedly short period of fifteen days, in which only four hundred and fifty-two tons of the six hundred tons of coal on board had been consumed. The fort on Bedloe's Island saluted the steamer with twenty-six guns, answering to the number of States of the Union at that time.

"'It had been agreed among us,' says our passenger, 'some days previously, that before we left the ship one of the tables should be christened Victoria, the other the President. Wine and fruit had been set upon them for this purpose: we were standing round the former of them; the health of Britain's Queen had been proposed; the toast was drunk; and amidst the cheers that followed, the arm was just raised to consummate the naming, when the fort opened its fire. The fire was electric. Our colors were lowered in acknowledgment of the compliment, and the burst which accompanied it from our decks—drinking the President and the country, and breaking wine again—was more loud and joyous than if at that moment we had unitedly overcome a common enemy. Proceeding still, the city became more distinct,—trees, streets, the people,—the announcement of the arrival of the ship by telegraph had brought thousands to every point of view upon the water-side; boats, too, in shoals, were out to welcome her, and every object seemed a superadded impulse to our feelings. The first to which our attention was now given was the 'Sirius,' lying at anchor in the North River, gay with flowing streamers, and literally crammed with spectators,—her decks, her paddle-boxes, her rigging, mast-head high! We passed round her, receiving and giving three hearty cheers, then turned towards the Battery. Here myriads seemed collected,—boats had gathered around us in countless confusion, flags flying, guns were firing, and cheering again,—the shore, the boats, on all hands around, loudly and gloriously, seemed as though they would never have done. It was an exciting moment,—a moment which, in the tame events of life, finds few parallels: it seemed the outpouring congratulations of a whole people, when swelling hearts were open to receive and to return them. It was a moment of achievement! We had been sharers in the chances of a noble effort, and each one of us felt the pride of participation in the success of it, and this was the crowning instant. Experiment then ceased; certainty was attained; our voyage was accomplished.' In explanation of the allusion in the above to the 'Sirius,' we may here state that this steamship, which had sailed from Cork before the 'Great Western' left Bristol, had arrived a day or two before the latter

vessel; but the 'Sirius' only partially used her engines, not having stowage for sufficient fuel to keep them constantly plying."

1839.—The *Charleston* (S. C.) *Mercury* says, August, 1839, "Major John Lind, of Charleston, S. C., an officer of the United States Engineers, is justly entitled to the credit of the application of the *screw* in the place of the paddle-wheel to steamboats. More than five years since he explained the principle, and experimented successfully with a small model boat on the canal near Washington City."

1839.—The *New Jersey Journal*, August, 1839, says, "Mr. Samuel Dow, of Elizabethtown, upwards of *twenty years since*, made two small boats from twenty to twenty-five inches in length, one with a screw, and the other with paddle-wheels, in order to show the superiority of the screw. Each had a mast and a cord, the standing part of the latter fast and wound round the shaft or axle, and over a sheave in the mast-head, with equal weight attached. At the first going off, the wheel would go ahead, but before the race was half run, the screw would overhaul and shoot ahead.

"Mr. Dow built a boat twenty-five feet in length, with a screw on each side, to ship and unship as might be advantageous. It was worked by four men with a crank and cog-wheels."

The *Norfolk Herald*, October 7, 1839, says Mr. Benjamin Harris, of that borough, had conceived a plan by which sail-vessels of every description might be propelled with the aid of steam, by paddles operating vertically in the bottom of the vessel above the keel, connected with the machinery above by a perpendicular shaft working in a metal cylinder, constructed to exclude the water. In the larger class of ships, the boilers, engines, and all the machinery could be stowed away *below the water-line.*

Mr. Harris tested his idea on a skiff fourteen feet long and three wide, which, propelled by the hand, by a crank turning a paddle-wheel two and a half feet in diameter, made the rate of five miles an hour.

Many ingenious plans were proposed up to 1839, when the utility of the screw propeller was fully demonstrated, and a number of screw boats were placed on the lines of inland navigation connecting Lake Ontario with the St. Lawrence.

The keel of the "Great Britain," built at Bristol from designs and on calculations made by Mr. Brunel, was laid down in July, 1839, and launched on the 19th of July, 1843, His Royal Highness Prince Albert, the Prince Consort, honoring the event with his presence. She was of large dimensions for the time, having an extreme total length of 322 feet, 51 feet width of beam, 32 feet 6 inches depth of hold, and 3448 tons burthen by the old measurement. The "Great Britain" was among the first ocean-going steamships built of iron, and also among the first of that now numerous class navigated by a screw propeller. Originally she had six masts, which were afterwards reduced to three. The

screw was worked by engines of 1000 horse-power, but were changed to engines of 500 horse-power nominal. She was intended to be employed between Bristol and New York as the companion ship of the "Great Western." Besides being very strongly framed, she was divided into *six water-tight* compartments, which proved their utility when on her voyage from Liverpool to New York, with one hundred and eighty-five passengers on board, she was stranded on the 22d of September, 1846, in Dundrum Bay, on the Irish coast, where she lay till the 25th of August, 1847, exposed to all the storms which swept that rugged and tempestuous coast. When floated off, she was found to have sustained little or no damage. During the Crimean war she was employed by the British government as a transport, and afterwards run to Australia as a passenger-ship, with machinery and equipments modified to suit the service. She was still on that route in 1876.

It is said the "Great Britain" was originally intended for a paddle steamer, but, the company having been unable to induce any forge-master to undertake the forgings required for the paddle-shafts, necessity compelled the adoption of the screw propeller. After her launch she was imprisoned several months in Cumberland dock, Bristol, owing to the locks being narrower than the ship, which necessitated their being widened. She was released from her long and ludicrous durance December 12, 1844, and early in 1845 steamed round to London. Her propeller was fifteen and a half feet in diameter.

The "Great Western" ran regularly between Bristol and New York till the end of 1846. In 1847 she was sold to the West India Royal Mail Steam Packet Company, and was considered one of their best vessels. She was broken up in 1857, at Vauxhall, being unable longer to compete profitably with the new class of steamers.

The "President" was launched December 7, 1839, with great *éclat*, and sailed on her first trip to New York August 1, 1840; but her career at sea was very brief, and may be summed up in a few words. When due from New York in April, 1841, she failed to make her appearance: tremendous weather having been experienced in the Atlantic, with unusual quantities of ice in very low latitudes, the greatest anxiety was felt for her safety. The "President" was never again heard of, nor was any trace of her wreck ever discovered. Her figure-head was a bust of Washington after Canova.[50]

The "Liverpool" was built in the city for which she was named, and

[50] On the 23d of April, 1841, in lat. 41, long. 70, a Portuguese brig saw a large steamship under sail going about four miles an hour. No smoke issued from the funnels (the "President" had two), and the paddle-wheels were not in motion. The captain of the brig saw the steamer on the following day, and even approached within three or four miles of her while pursuing his homeward route. She did not hail the brig, nor did she appear to be at all in a disabled state. A British man-of-war and two Portuguese vessels were sent to cruise in search of the "President," but without success.

was dispatched to New York, October 20, 1838, by Sir John Tobin, a well-known merchant; put back to Cork October 26. She again proceeded November 6, and made the passage in sixteen and a half days, arriving at New York November 23. At first she was of 1150, but her tonnage was subsequently increased to 1543, and she obtained the name of the "Great Liverpool." She made in all six voyages to and from New York, when she was transferred to the Peninsular and Oriental Company, and in 1846 was totally wrecked off Cape Finisterre.

The "British Queen" sailed from Portsmouth, England, on her first trip, July 13, 1839, with a full complement of passengers, a crew of one hundred men, eight hundred tons of goods, and six hundred tons of coal. She cost three hundred thousand dollars, and when leaving the harbor was said to have afloat in her property to the value of seven and a half millions of dollars. She was sold to the Belgian government in 1841.

The "British Queen," from Bristol, foundered September 1, 1843, with many passengers, nearly all of whom were saved. Was this the same vessel?

The "Columbia," of the Cunard line from Liverpool to New York, was wrecked on the rocks off Seal Island July 2, 1843. No lives lost.

The following table exhibits the size and power of the earliest and largest transatlantic steamships:

Dimensions and Power.	Names of Vessels.				
	British Queen.	President.	Great Western.	Liverpool.	Acadia.* Britannia. Caledonia. Columbia.
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
Length from figure-head to taffrail	275	273	240	234	228
Length of upper deck or between the perpendiculars	245	243	....	212	206
Breadth within the paddle-boxes	40	41	....	35 4	34 4
Breadth over all	61	68	57	58 4	56
Depth of hold	27	30	20	23 3	22 6
Diameter of paddle-wheels	31	30	....	28	78
Diameter of engine cylinder	6 5½	7 6	....	6 1	6
Length of stroke	7	7 6	....	7	6 10
Power of engines	500 H. P.	600 H. P.	460 H. P.	464 H. P.	425 H. P.
Tonnage	2016	2366	1340	1543	1150

* These were the first four steamships of the "North American Royal Mail Line," better known as the Cunard Line. The vessels named were respectively of 1154, 1135, 1138, and 1175 tons, and probably varied slightly from the dimensions given in the table.

Timbs, in his Year-book for 1840, says the "British Queen" and "President" were the two largest ships in the world.

In 1840, Lieutenant Wall, R.N., communicated some interesting papers to the *United Service Journal* "On the Construction, Proportions, and Power best adapted to Sea-going Steam Vessels," in which he presented arguments in favor of building and supplying large steamers with three instead of two engines, and set forth the advantages which would counterbalance the increased expense, weight, and friction of a third cylinder.

The same year M. Scott Russell arrived at this "very remarkable result:" "That in a voyage by a steam vessel in the open sea, exposed of course to adverse winds, there is a certain high velocity and high portion of power which may be accomplished with less expenditure of fuel and of room than at a lower speed with less power."

The Secretary of the United States Navy, in 1840, in his official report, stated that England, in 1836, had 600 steamers at home and abroad, and in 1840 the number of steamers in the United States was 800, of which 600 belonged to the Western waters, where in 1834 there were about 254. About 140 belonged to the State of New York. In tonnage, in 1840, the United States had 155,000 tons of steam shipping, and Great Britain 68,000.

The Society of Arts this year awarded Mr. Jennings a silver medal for his invention of night signals for steamers in 1839. A small iron steamer was built in England, appropriately named "The Anthracite," especially adapted to burning that kind of coal.[51]

July 10, 1840, the "Cyclops" steam frigate, at that date the largest and most powerful steam man-of-war in the world, was launched at the Pembroke Dock-yard. Her dimensions were: length, 225 feet; beam between paddles, 38 feet; depth of hold, 38 feet; tonnage, 1300. She was 200 tons larger than the "Gorgon," launched from the same slip two years before. She had a complete gun-deck as well as upper or quarter deck, and on her main deck mounted eighteen long 36-pounders, and on the upper deck four 48-pounders and two 96-pounders, "tremendous guns on swivels, carrying a ball ten inches in diameter, and sweeping around the horizon 240 degrees."

She was commanded by a post-captain,—she and the "Gorgon" being the only steamers in the Royal Navy at that date taking post rank. Her crew consisted of 210 men, 20 engineers and stokers, and a lieutenant's party of marines, *who had charge of the guns.* All the guns were upon sliding fixed pivots. She was schooner-rigged, and, with six months' stores and twenty days' fuel, drew only fifteen feet of water. Her orlop-deck could store 800 troops and their officers with comfort. She was built in six months, on plans of Sir William Symonds, and had engines of 320 horse-power.

The steamer "Nicholai," of eight hundred tons, was built at Deptford, in 1839, to run between Lubeck and St. Petersburg, and the Messrs. Laird & Woodside, of Liverpool, shipped in sections the hulls of three iron steamboats to be set up in Montevideo.

January 29, 1839.—The "R. T. Stockton" (screw) towed the American packet-ship "Toronto," 650 tons, and drawing 16¼ feet water, from Blackwall to the lower points of Woolwich, 3½ miles, in 40 minutes, against a flood-tide running 2 to 2½ miles an hour.

"The fact of this body having been moved at the rate of upwards

[51] Mechanics' Magazine.

of six miles an hour, by a propeller measuring only 6 feet 4 inches in diameter and occupying less than 3 feet in length, is one which, scientifically considered, as well as in a practical and commercial point of view, is of immense importance."[52]

The "Nemesis," commanded by Captain W. H. Hall, which sailed from Portsmouth March 28, 1840, was the first iron steamer that ever rounded the Cape of Good Hope. She arrived at Table Bay July 1, left on the 11th, but, meeting with severe gales, put into English River, Delagoa Bay, to refit, which occupied three weeks, when she resumed her voyage up the Mozambique Channel to India and China, where she performed gallant service. She was 168 feet long, 29 feet beam, and 650 tons burthen. She was fitted with five water-tight compartments.

The "Archimedes," an iron screw steamer, in 1840 made an experimental trip around the island of Great Britain, or 1722 miles, in 210 hours, being on an average about 8½ miles an hour.

The first application of Hall's reefing paddle-wheels was to the iron steamer "Lee," in 1840.

Early Compound Engines, 1829–1837.—A comparatively little known work, by C. A. Tremtsuk, published at Bordeaux in 1842, contains some interesting particulars of the steamers plying at that time on the Gironde and the Garonne. One of these vessels, the "Union," launched in June, 1829, had a compound engine constructed by Hallette, of Arras. This engine had two inclined cylinders, the connecting-rods taking hold of the same crank-pin. The cylinders had diameters of 15 and 15.8 inches respectively, and the stroke in each instance was 26 inches. The engine was run at thirty revolutions a minute under a pressure of sixty-six pounds of steam. Another example of an early compound engine was that which in 1842 was in use in the steamer "Le Corsaire Noir." It was built in 1837 by Fol, Sr., of Bordeaux, and had three oscillating cylinders, two of them being each 10.78 inches in diameter, with 39.4 inches stroke, and the third having a diameter of 21.27 inches, with a stroke of 32 inches. The three cylinders acted on three different cranks. The two smaller cylinders received the steam from the boiler at a pressure of seventy-four pounds, and discharged it into an intermediate receiver, from which it passed to the large cylinder and then to the condenser.

1839.—The steamer "Argyle" sailed from Liverpool, April 6, 1839, for New Orleans *via* Cadiz and Madeira; and the "Chili" sailed from Falmouth, and the "Peru" from London, July 2, 1839, for Valparaiso and Callao *via* Rio Janeiro.

1840.—The *Edinburgh Observer* of 1840 says, "An ingenious mechanic residing at Grahamstown has been for a long period engaged in constructing a small vessel to be propelled by pressure-pumps. The

[52] Timbs, in the Year-Book of Facts for 1840.

boat was launched into the Forth and Clyde Canal at Bainsford bridge, and proceeded along the reach at a rate of not less than fifteen miles per hour, conducted by the inventor alone, who worked the pumps. He had no doubt that his invention would entirely supersede the use of paddle-wheels."

The *London Morning Chronicle* for 1840 says, "Experiments were tried with a model of an entirely new form of steam vessel, and with every prospect of a successful result. In this remarkable invention there are no paddle-wheels, nor external work of any kind. The whole machinery is in the hold of the vessel, where a horizontal wheel is moved by the power of steam, and, acting upon a current of water admitted by the bows and thrown off at the stern, propels the mass at a rapid rate. By a very simple contrivance of stop-cocks, etc., on the apparatus, the steamer can be turned on either course, retarded, stopped, or have her motion reversed."

An officer of the United States Navy obtained a patent in 1840 for a similar improvement; his model was examined by scientific gentlemen in Washington, who highly approved of it. The whole machinery was situated below the water-line, out of reach of shot.

In 1840, Samuel Cunard, of Halifax, started the line of ocean steamers known by his name. It was the first permanently successful line of transatlantic steamers. The "Britannia," the first regular steamer of the line, left Liverpool, July 4, 1840, and arrived at Boston, July 18, 1840, fourteen days and eight hours from Liverpool.

Cunard had for years conducted a line of packet-brigs between Halifax and England,—tub-like vessels widely known as coffins, several having foundered under the wintry waves of the Atlantic. Mr. Cunard accepted a subsidy and laid the keels of four steamers of eight hundred tons to run between Halifax and Liverpool, with a small connecting steamer to run from Halifax to Boston. On his return to Nova Scotia by the "Great Western," he was stopped at Bristol by news from America. Resolutions, prepared by a member of the Suffolk bar, had been presented at a large meeting in Boston and adopted by acclamation. With these in his hand, Cunard returned to London and waited on the Admiralty. "See," he says, "my predictions are verified. I told you the boats were too small; the Bostonians say they must come through to Boston, and that they will settle the question of the North-east boundary. Give me ten thousand pounds more and I will enlarge the steamers and extend my route to Boston." They gave him the additional sum; he went back to Glasgow, broke up the keels already laid, and built the "Britannia," "Acadia," "Caledonia," and "Columbia," the pioneers of his line to America.[53]

1842.—The steamship "Bangor," from Boston, *via* Halifax and

[53] See the history of the line in succeeding pages, also table on page 128.

Pictou, arrived at Fayal on the 19th September, 1842, in ten days from the latter port. She was to leave on the 21st for Constantinople, touching at Gibraltar and Malta.

She was at one time the steam-yacht of the Sultan, and later was employed in conveying Mahommedan pilgrims towards Mecca. She was a side-wheel steamer, built in New York to ply between Boston, Portland, and Bangor, Maine, and was some time on that route. On her voyage to Gibraltar her lower cabins were converted into coal-bunkers, and her upper cabins removed.

THE FRENCH STEAM NAVY.—The following is the list of the French war-steamers in 1840, with their power: The "Lavoisier," 220 horse-power; "Véloce," 220; "Chaméléon," 220; "Gassendi," 220; "Majeur," 160; "Sphinx," 160; "Ardent," 160; "Crocodile," 160; "Fulton," 160; "Chimère," 160; "Styx," 160; "Météore," 160; "Vulture," 160; "Phare," 160; "Acheron," 160; "Papin," 160; "Cerberus," 160; "Tartar," 160; "Etna," 160; "Brandon," 160; "Cocytes," 160; "Phaeton," 160; "Tonnerre," 160; "Euphrates," 160; "Gregerois," 160; "Grondeur," 160; "Ramier," 150; "Castor," 150; "Brasier," 100; "Coureur," 80; "Flambeau," 80; "Corsier," 60; "Erebus," 60; "African," 40. To these must be added seven other boats on the stocks,—the "Asmodeus," "Pluto," "Infernal," "Gomore," "Tonare," "Cuvier," and "Chaptal," which gave France an effective force of forty-one steamboats, whilst the English had nearly twice as many. The "Gomore," of four hundred and fifty horse-power, was to carry thirty-four guns under a covered battery, and the "Infernal" was three hundred and twenty horse-power.

On the other hand, the English had the "Cyclops," which could mount sixteen long thirty-twos, four pieces of forty-eight on its quarter-deck, and two of ninety-six,—in all twenty-two guns. She could carry coal for twenty-five days' steaming, and take one thousand soldiers on her deck; four hundred troops across the Atlantic, or three hundred to India. Her usual rate of sailing was eleven knots an hour. She beat in sailing, without using the engine, in a passage of three hundred miles, the "Pantaloon," the fastest brig in the Royal Navy. Her crew comprised two hundred and twenty seamen in time of war, and one hundred and seventy-three during peace. Independent of these war-steamboats, Great Britain had immense resources in her commercial steam navy, which consisted of eight hundred and ninety-nine steamboats, aggregating a force of sixty-eight thousand one hundred and forty-five horse-power. Among these were thirty-three steamboats, of from four hundred and fifty to seven hundred horse-power, which traded to the United States, South America, and India.

The *London Nautical Magazine* for 1842 notes the following vessels with *screw propellers* as having been built or then building in Great Britain, viz.:

Already built.

"Archimedes,"	237 tons,	70	horse-power,	belonging to	London.
"Princess Royal,"	101 "	45	"	"	Brighton.
"Bee,"	30 "	10	"	"	Portsmouth.
"Beddington,"	270 "	60	"	"	South Shields.
"Novelty,"	300 "	25	"	"	London.

Building.

"Great Britain," 3600 tons, 1000 horse-power, belonging to Bristol.
"Rattler," 800 " 200 " " "
Two for the French government of 230 horse-power.
One " " " " 350 "

Propellers had been fitted to other vessels with various success. The old river steamer "Swiftsure" was fitted with one, and an increased speed attained by it. The "Great Britain" is described in the volume as the "largest vessel in the world; but the most noble feature about her is her newly-improved screw propeller, patented by Mr. Smith, of London, and applied by him with complete success to the 'Archimedes.'"

In 1842 steam navigation was established on the Indus. The iron steamers "Planet" and "Satellite," originally intended for the Rhine, were purchased by the East India Company, sent out in sections, and put together in the dock-yards in Bombay. In 1844–45 the "Napier," "Conqueror," and "Meance" were added to the line; all these had engines of sixty horse-power.

In 1842 H. B. M. steamship "Driver" circumnavigated the globe, the first steamship to perform this feat.

Screw propulsion was introduced into the United States Navy, and, indeed, it may be said into the United States, in 1843, by the construction of the "Princeton," a steamship classed as a second-rate sloop-of-war.

This vessel was designed by and constructed under the superintendence of Captain John Ericsson, a Swede by birth, but a resident of New York. *She was the first screw steam war-vessel ever built.*

Her dimensions were:

Length on deck	164 feet.
Length between perpendiculars	156 "
Extreme beam on deck	30 " 6 inches.
Depth of hold to berth-deck	14 "
Depth from berth to spar-deck	7 " "
Total depth of vessel	21 " "
Measurement burden	673 tons.
Launching weight of hull	418 "
Displacement at 16½ feet draught	954 "
" at 18 " "	1046 "
Immersed midship section at 16½ feet draught	346 square feet.
" " " " 18 "	390 " "
Draught of water at deepest load, with 200 tons of coal on board	19 feet 4 inches.
Draught of water, with 100 tons of coal in, after bunkers and provisions and water for the crew half out	forward, 14¾ feet. aft, 18¼ "
Mean draught of water with half coal out and all other weights full	17 feet.

The peculiarity of her model consisted in a very flat floor amidships, with great sharpness forward, and excessive leanness aft, the run being remarkably fine, with a great extent of dead-wood terminating in a stern-post of the unusual thickness of twenty-six inches at the centre of the propeller-shaft, but tapering above and below. This dead-wood and stern-post was pierced by a hole thirteen inches diameter.

Other of her peculiarities were that for *the first time in a vessel of war all of her machinery was placed entirely below the water-line, out of reach of shot.* She was also the first war-steamer to burn anthracite coal, thus avoiding the dense volumes of black smoke which revealed all foreign war-steamers. She was also the first steamer provided with telescopic funnels, to be lowered out of the way of the sails, and the first to use blowers. She was provided with direct-acting engines. Ericsson, who devised her, was the first also to couple the screw directly to the engine.

1840–50.—The first experiments tried by the British Admiralty with the screw propeller were made, as we have shown, in 1840–41, and during the next three years—1842–44—eight screw vessels were *ordered* to be built. This number was augmented by twenty-six in 1845. In 1848 there were forty-five screw steamers in the Royal Navy.

An official report of the result of various trials of the performance of screw steamers, dated May, 1850, states it "as highly probable that fine sailing-vessels, fitted with auxiliary screw-power, would be able if not to rival, at least to approach full-powered and expansively-acting steamships in respect of their capability of making a long voyage with certainty and in a reasonably short time." "Another application of the screw, although inferior in general importance to its application as a propeller to ordinary ships," says the same report, "is as a manœuvrer to those large ships in which engines of considerable power cannot be placed, or in which it is considered unadvisable to place them. No doubt can be entertained of the efficiency of such an instrument worked by an engine of even fifty horse-power. The full extent of its utility, however, cannot, perhaps, be thoroughly appreciated until it shall have been extensively used in Her Majesty's navy."

1843.—The "Rattler," the first screw vessel of war added to the Royal Navy, was ordered to be built to test the method of screw propulsion. That the experiment might be conclusive, so far as a trial could be made between two vessels, she was constructed on the same lines as the "Alecto" (her after part being lengthened for the insertion of the screw), and she was fitted with engines of the same power, and on a plan which had previously been tried with paddle-wheel vessels. So doubtful were the Lords of the Admiralty of her success that the space on her broadside where paddle-wheels were usually inserted was kept

clear of gun-ports in order that wheel-houses might be appended in case of the non-success of the screw; and this was the state of her broadside when she was in China, in 1853–54.[84]

The "Rattler" was launched from Sheerness Dock-yard in April, 1843. She was considered a remarkably fine model, and of very unusual length in proportion to her beam, her dimensions being one hundred and ninety-five feet extreme length, thirty-three feet extreme breadth, and eighteen and one-half feet mean depth of hold. Her burden was eight hundred and eighty-eight tons. The river trials of the "Rattler" lasted from October, 1843, to the beginning of 1845, and showed that the screw-shaft might be advantageously reduced in diameter, and the blades by about one-third of their length; an alteration which greatly reduced the weight of the screw, and facilitated the shipping and unshipping of it, also rendering unnecessary the wounding or weakening to so great an extent the after part of the vessel. The result of the experiments with the "Rattler," was that the aperture in future vessels might be of very moderate dimensions without lessening the propelling power of the screw, and that in smooth water the screw was not inferior to the paddle-wheel. Early in 1845 the "Rattler" proceeded in company with the "Victoria and Albert," and the "Black Eagle," from Portsmouth to Pembroke. When rounding Land's End, both these vessels steaming against a strong head-wind, their paddles being constructed on the feathering principle, proved superior to the "Rattler," which left an unfavorable impression as to the efficiency of the screw against wind and sea in heavy weather, and this impression continued for several years, although when next tried, in a run from the Thames to Leith, in speed she was decidedly superior to paddle-wheel steamers of greater tonnage. Before joining the squadron of Rear-Admiral Hyde Parker, in July, 1845, the "Rattler" was employed to tow the "Erebus" and "Terror" to the Orkney Islands on their fatal expedition to the North Pole.

July 19, 1843.—The "Great Britain" was launched, being up to that date the largest and finest vessel built for ocean steam navigation. She was built at Bristol, and her lines were furnished by Mr. Patterson, who had planned and constructed the "Great Western." She was constructed of iron, and her dimensions were, length of keel two hundred and eighty-nine feet, two hundred and ninety-six feet between perpendiculars, and three hundred and twenty-two feet over all. Her extreme breadth was fifty-one feet, with thirty-two feet six inches depth of hold, her main load draught of water being sixteen feet; and her measurement two thousand nine hundred and eighty-four tons, with engines of one thousand horse-power. Though originally intended for a paddle-wheel steamer, her builder boldly resolved to adopt the screw, then

[84] My informant of this fact was Captain Fellowes, R.N., who commanded her at that time.

little known. His adoption of iron for the hull and a screw for propulsion led to much discussion among scientific men, and created many evil forebodings as to her ultimate fate. On her first passage from Bristol to the Thames she encountered severe weather, and braved the storm in such a manner as to silence the opponents of iron and the screw. On her arrival in the Thames, Queen Victoria, Prince Albert, and many of the nobility, and thousands of other persons visited her.

Soon after her experimental trip, December, 1844, she was placed on the American station. Her career was practically closed by her being stranded on the coast of Ireland. During the whole winter she lay on the beach at Dundrum Bay, Ireland, but sustained little injury. Altered and repaired, the "Great Britain" is said to be still employed in the trade between Liverpool and Australia, to all appearance as sound a vessel as she was when launched.

1844–1871.—The first English steam collier was built in 1844. She was bark-rigged. The "King Coal," as she was appropriately called, one of the latest, was contracted for in 1870, and cost complete for sea fifteen thousand pounds. She carries nine hundred tons coal cargo, with burden space for one hundred tons more, and has extra water-ballast when she has no cargo on board; against strong winds her speed is eight and a half knots an hour loaded, and from nine and a half to ten knots in fine weather when light; her power, ninety horse nominal. She has a saloon-cabin on deck for the captain, with four berths aft, and accommodation for chief mate and steward forward. Her crew all told is seventeen. Her voyages from New Castle to London and back usually occupy six to eight days. Hoisting sails, lifting the anchor, and other heavy work is done by steam winches. The crew have a roomy and well-ventilated forecastle level with the main-deck; the seamen occupy one side, the stokers the other, with a bulk-head between. The engineers have cabins on deck in the bridge-house. The wheel-house is amidship, and the helmsman is protected from the weather.

The ordinary sailing collier delivered in the course of the year under the most favorable circumstances three thousand five hundred tons of coal. The screw collier, with a complement all told of seventeen men, conveys annually, on the same round, fifty thousand tons.

1844.—Steam propellers, carrying principally freight, but some passengers, commenced navigating Long Island Sound in 1844. The first was called the "Quinebaug."

November 18, 1844, the propeller schooner "Midas," Captain William Poor, owned by R. B. Forbes, of Boston, left New York for China. She was the first American steam vessel that passed beyond the Cape of Good Hope, and was the first American screw steamer to ply in the waters of China. She was disabled by neglect to her boilers, and came

home *via* Rio Janeiro under sail, and ran for a long time after between Savannah and Rio Janeiro as a sailing-vessel.

1845.—January 18, 1845, the propeller bark "Edith," Captain George W. Lewis, also owned by R. B. Forbes, left New York for Bombay and China. She proceeded from Bombay to China in twenty-one and one-half days, beating all competitors. She was the first American steamer that visited British India, and the first square-rigged propeller that went to China under the American flag. She was purchased by the United States government during the war with Mexico, and, after running in the Gulf of Mexico for a year, went around Cape Horn, and was lost near St. Barbara, on the coast of California.

In April, 1845, R. B. Forbes contracted with Ericsson to build an iron paddle-wheel steamer of great speed, called the "Iron Witch." She was about three hundred feet long, and was the first *iron* passenger steamer that plied on the North River. She had side propellers in place of paddles, and was found not fast enough to compete with the Albany boats. Her engines were taken out and put into a wooden hull; and the wooden vessel called "The Falcon," bought by George Law, was the first steamer under the American flag that plied to Chagres, in connection with the California route.[55]

A notable event in the history of the "Britannia," the pioneer ship of the Cunard line, was the cutting a channel for ten miles in length, in Boston Harbor, in 1844, through the ice in order that she might sail at the appointed time. "Those who remember the month of February, 1844, will recall one of the most astonishingly cold periods of the last fifty years. The first of the month was agreeable enough for winter, but three or four days of intense cold came upon us about the middle of it. Ice rapidly formed in the harbor, and soon the whole distance from the wharves to Fort Warren was frozen over. Men, women, and children enjoyed the novel experience of walking all over the harbor. Skaters went to the outermost edge of the ice. Horses and sleighs entered on the ice-field from South Boston. Booths were established for the supply of creature comforts, bonfires lighted to warm the hands and feet of pedestrians, the earliest ice-craft with extended sail was seen skimming over the smooth surface, and the days and nights in the harbor partook of a carnival. But it was a serious matter to the agent of the Cunard line, who had the steamer 'Britannia' in port, and she was under contract to carry the mails, and must somehow get out to sea. Bostonians had some interest in the matter, too, for the line had but recently been established, and here was a fulfillment of the prophecy of the jealous New Yorkers, who had said it was an ice-locked harbor in winter. With characteristic energy and public spirit the merchants met at the Exchange one day, as the time for the sailing of the steamer neared, and no south wind had come to loosen the frost's hold on the

[55] See account of George Law's line in succeeding pages.

waters, and resolved upon the undertaking of cutting a channel for the steamer from her dock to the open bay,—a pathway of over ten miles. Mr. John Hill, with some experience in ice-cutting, was selected for the job, but it proved too much for him. At this juncture Mr. Jacob Hittinger, of Gage, Hittinger & Co., large ice-cutters upon Spy Pond, in West Cambridge, contracted with the merchants to liberate the steamer. The task was accomplished, and the 'Britannia' on her appointed sailing-day moved majestically through the canal, a hundred feet wide, to the open ocean, amid firing of cannon and the cheering of thousands, the multitudes not only lining all the wharves, but flocking upon the solid ice in countless numbers. Probably never again will we witness the spectacle of an ocean steamer moving down the harbor accompanied by thousands of people running or skating by her side. The tug-boats which have come into service by scores have rendered the freezing of the harbor practically impossible, as on the slightest indication of ice they are abroad to break it up. Gage, Hittinger & Co. received ten thousand dollars for this immense job, which actually cost them twenty thousand dollars, but they enjoyed the satisfaction of being recognized as enterprising and successful men in the venture."[56]

1845.—Early in 1841, Thomas Butler King, of Georgia, for many years chairman of the Committee of the United States House of Representatives on Naval Affairs, introduced a resolution directing the Secretary of the Navy to advertise for proposals for mail steamships to run to European ports, and for a coastwise line between the North and the South. Persevering in his efforts from session to session, he succeeded in having a bill passed in 1845 placing the arrangement for the transportation of the mails to foreign countries under the direction of the Postmaster-General, and authorizing him to solicit proposals for several routes. This led to the formation of the Ocean Steam Navigation Company of New York, which, in 1847, built and placed the "Washington" and the "Hermann" on the route to Southampton and Bremen. They were the first American ocean steamships after the "Savannah," and at the time of their construction the best specimens of sea steamers our constructors and engineers had produced. Their average passages from Cowes to New York was thirteen days fourteen hours and fifty-three minutes; from New York to Cowes, fourteen days seven hours and seventeen minutes. The contract between this "Ocean Steam Navigation Company" and the United States was for them to carry the United States mails between New York and Bremen twice a month, touching at Cowes, the compensation to be two hundred thousand dollars per annum. The two steamships were two hundred and twenty-four feet long, thirty-nine feet broad, and twenty-nine feet deep, and measured seventeen hundred tons. At the expiration of the

[56] *Commonwealth* newspaper.

contract the line was discontinued, the steamers were sold and transferred to the Pacific, where, in 1863, the "Hermann" was broken up, and a few years later the "Washington" was wrecked.

Captain R. B. Forbes says, "In 1845 I built the auxiliary steam propeller 'Massachusetts' for myself and others, and sailed in her on the 15th of September, or thereabouts, from New York for Liverpool, and arrived on the 2d October, having used steam nearly eleven days out of seventeen and a half. This was the first packet-ship under steam that started and performed more than one complete voyage between the United States and England under the American flag, and was the first propeller that was put into the trade." The propeller "Marmora" went to England before the "Massachusetts," on her way to the Mediterranean, and the steamer "Bangor" (paddle) went to Gibraltar; but the "Massachusetts" was the first regular steam packet-ship between us and England under our flag.

The propeller of the "Massachusetts" was of composition metal, nine feet in diameter. She had two cylinders of 17,640 cubic inches each, set at right angles. The propeller was contrived to take out of the water at pleasure, and when out of water the ship was a perfect sailing-ship of about seven hundred tons. She made two voyages from New York to Liverpool and back, and was then chartered, and afterwards sold to the War Department. General Scott had his flag on board the "Massachusetts" at the taking of Vera Cruz.

Her engines were subsequently taken out, and she was converted into a sailing-bark, and renamed the "Fananoles" of San Francisco, and was in existence at the close of our civil war, and for aught I know to the contrary "still lives."

1846.—In 1846 there were eleven steamboats running between London and Westminster Bridges on the Thames at *one penny* the trip, making thirty-two trips in the hour, or three hundred and twenty trips per diem. Assuming forty as the average number of passengers for each trip, the daily total would be fifteen thousand, and the return trip being the same, one hundred and twenty-five pounds was about the daily receipt of these boats. The time of each trip varied from one-quarter to one-half hour.

The American steamer "Oregon," the most magnificent steamer afloat in 1846, maintained a speed, against a west-northwest gale and head sea, of twenty miles per hour. In calm weather she made an average speed of twenty-five miles per hour. Her length was three hundred and thirty feet, by thirty-five feet width of beam, and her measurement one thousand tons, with berth accommodations for six hundred passengers. Her engine was of eleven hundred horse-power, and had a seventy-two-inch cylinder with eleven feet stroke. On the main-deck, the inclosed space from the ladies' cabin forward formed a promenade two hundred feet long. The massive engine in the centre, and four or

five side parlors, fitted up with ten or twelve berths each, opened out over the guards, as also a smoking-room, denominated the "Exchange," and the wash-room and barber's shop,—the latter fitted up with marble slab, Croton water, wash-bowls, etc. In the main cabin, a continuous line of berths extended over three hundred feet from end to end of the boat, numbering some two hundred berths. This included the after-cabin, which was connected by an ample passage-way with the forward one. Five hundred yards of carpeting covered the floors in these cabins. Each berth was fitted with Mackinaw blankets and Marseilles quilts, having the name of the steamer worked in them. A thirty-pound mattress, and also bolsters and pillows, with linen of the finest quality, completed the equipment of the berths. The curtains were of satin de laine of rich tints, with embroidered inner curtains.

"A portion of the after-cabin was set aside for ladies, and distinguished by extra trimmings, blue and gold curtains, etc. The dining-saloon accommodated two hundred and fifty persons. The table service was of the richest French china, every article marked with the name of the steamer; the glassware was heavy star-cut. The silver-plated ware was of Prince Albert pattern, very heavy and costly. But the transition from this show-room to the ladies' upper cabin was as great as from that of a common ferry-boat cabin. There the magnificent fittings dazzled the eye. Nothing was wanting which could add richness, splendor, or luxury. There were seven tiers of berths and three state-rooms upon each side, the cabin being seventy feet long. At the extreme stern was the wash-room, fitted with even more comfort than that for gentlemen. Each side of the entrance were full-length mirrors, that at first glance were often mistaken for doors opening into another cabin. The state-room doors were of enameled white, richly gilt, and their interior embellishments, like the cabin, splendid and beautiful. The front of the ladies' cabin from the main-deck was splendid. The architecture was plain, with an enameled white ground profusely gilt, with raised flowers upon the gilt pillars. A time-piece was placed over the door and stained glass around it."

The "state-room hall" on the upper deck was two hundred and twenty feet long by sixteen wide, except the space occupied by the engine in the centre. Out of it opened sixty state-rooms, furnished in sumptuous style; three were double ones, and a fourth was fitted up as a "bridal-room" with good taste, and with a wide French bedstead, etc.

Forward of this hall was a lounge, from which there was an unobstructed view ahead of the progress of the boat and passing objects. Astern was a promenade-deck. State-room hall and the main cabin were adorned with superb mirrors set in rich frames. The cost of the furniture and fittings was thirty thousand dollars, and of the boat itself about one hundred and thirty thousand dollars. She was built under the superintendence of her commander, Captain St. John, and

her symmetry, the beauty of her model, and the arrangement of her engines, which gave her unrivaled speed, were the result of his long and practical experience.

The first regular American ocean mail steamship was the "Southerner." She was built in 1846, and put on the route between New York and Charleston, South Carolina. She was followed by the "Falcon" and others in the trade to Southern ports.

1847.—The first French Atlantic steamer arrived at New York from Cherbourg on the 8th of July, 1847.

In 1847, Messrs. C. H. Marshall & Co., owners of the celebrated Black Ball line of packet-ships, built for the New York and Liverpool trade the steamer "United States," of two thousand tons burden, which in April, 1848, sailed on her first voyage to Liverpool. She was the first American steamer built for the Atlantic Ocean freight and passenger trade, made several voyages, did not pay, was withdrawn and sold to parties in Bremen, and, I believe, was added to the navy of the new German Confederation.

1850.—The first steamers that ran to Havre from New York were American. The "Franklin" and "Humboldt" constituted the original Bremen line. Their average passage to Cowes was twelve days seventeen hours nine minutes. The "Humboldt" was two hundred and ninety-two feet long, forty feet broad, twenty-seven feet deep, and of two thousand eight hundred and fifty tons. The New York and Havre Steam Navigation Company, to which these steamships belonged, was established in 1848, to ply between Havre and New York, stopping at Southampton both going and returning, and obtained a contract for carrying the United States mails, for which they were to receive one hundred and fifty thousand dollars per annum for a fortnightly service. The "Franklin" was launched in 1848, and made her first voyage in 1850. She was two hundred and sixty-three feet in length, fifty-two feet beam, twenty-six feet depth of hold, and measured two thousand one hundred and eighty-three tons. In July, 1854, she was wrecked and totally lost on Long Island. The "Humboldt" made her first voyage in 1851, and was wrecked entering Halifax, Nova Scotia, in October, 1853.

To preserve the mail contract, the service was supplied by chartering unsuitable steamers at heavy cost until 1855–56, when the "Arago" and "Fulton" were built and placed on the line. On the breaking out of the Rebellion in 1861 the line was withdrawn. The "Arago" was sold to the Peruvian government, and the hull of the "Fulton" was broken up, dry rot rendering her useless as a sailing-ship. Her engines were utilized elsewhere.

1848.—The steamer "California," which left New York on the 6th of October, 1848, was the first steamer to bear the American flag to the Pacific Ocean, and the first to salute with a new life the solitudes

of that rich and untrodden territory. She was soon followed by the "Panama" and "Oregon," and in due time by the "Tennessee," the "Golden Gate," the "Columbia," the "John L. Stevens," the "Sonora," the "Republic," the "Northerner," the "Fremont," the "Tobago," the "St. Louis," and the "Golden Age." These steamers found nothing ready to receive them in the Pacific. The company was compelled to construct large workshops and foundries for their repair, and had also to build their own dry-dock, that of the government at Mare Island not being ready until 1854. For a large portion of the early time the company had to pay thirty dollars per ton for coal, and once as high as fifty dollars per ton.

1849.—The "Georgia," built in 1849 for George Law's line to Aspinwall, exhibited in her model the first signal departure from the now worn-out type of sailing-packets, once so celebrated.

On the 4th of June, 1849, the "Panama" entered the harbor of San Francisco, California, on her pioneer trip from New York *via* Panama, and twenty years after, viz., June 4, 1869, a correspondent of the *Evening Bulletin* recalls the notable event:

"Twenty years ago this morning the steamship 'Panama' entered this harbor on her pioneer trip from New York *via* Panama, bringing about three hundred and eighty passengers from the latter port, many of whom had been detained there a month or two on their way to the land of gold.

"As I am not advised of any meeting in the way of a dinner or social reunion to celebrate the anniversary, it has occurred to me that a short reference to it in your columns would be appropriate. There are many still living in this city and throughout the State who will remember the joy they experienced soon after sunrise that morning on entering and steaming up the magnificent Golden Gate, at the end of their seventeen days' voyage from Panama. The fuel had given out, and the writer well remembers that Captain Bailey told him he had to make use of some of the light wood-work of the ship in order to keep up steam enough to work the vessel into port.

"Among the passengers were General Joseph Hooker, Governor John B. Weller, Dr. William Gwin, Hon. T. Butler King, Lieutenant Geo. H. Derby (Squibob), and other official characters; also Messrs. Hall McAllister, John Bensley, Lafayette Maynard, H. B. Livingston, Alfred DeWitt, S. C. Gray, John A. Collins, H. Beach Brinsmade, and others who have since attained eminence in their several vocations. Among this crowd of three hundred and eighty men were some five or six ladies, who deserve to be remembered for their nerve and heroism in braving the dangers of a pioneer voyage to a new and undeveloped country, far away from the social and domestic comforts of their old homes. These were Mrs. J. C. Fremont (whose distinguished husband was then on an exploring expedition across the Gila country, and whose

safe arrival was then in great doubt), Mrs. Robert Allen[87] (wife of the quartermaster-general of this coast), Mrs. Alfred DeWitt, Mrs. S. C. Gray (of Benicia), Mrs. Hobson, from Valparaiso, and another, whose name has escaped me. These ladies are all, I believe, still living to look back with satisfaction upon the morning of the 4th of June, 1849.

"We then indulged in the speculation that in twenty years the railroad might be built across the continent, and now, lo and behold, this dream is realized! Henceforth no long and weary voyage through the tropics need be taken to come and go 'to the States,' for we are *in* the States, and a single week only is necessary to perform a journey which, in those days, it took at least a month to accomplish.

"COTTON.

"SAN FRANCISCO, June 4, 1869."

The "Panama" was commanded by Lieutenant David D. Porter, now "The Admiral" of the United States Navy.

In 1849, Mr. R. B. Forbes, of Boston, sent out to California, on the deck of the ship "Samoset," an iron steamer called the "Mint," about seventy-five feet long by fifteen beam. She was launched under steam, and was stowed on the starboard side, the deck-house being removed over to the port side to balance her. She was the first American steamer to ply on the Sacramento.

In 1850 he sent out an iron paddle-wheel steamer in two parts to China on the deck of the brig "Rolling Wave," on account of J. B. Endicot.

1850.—In the autumn of 1850, Mr. Peter Borrie launched what he called a "safety iron twin steamer," which he appropriately called the "Gemini," adapted for carrying goods, passengers, cattle, and all sorts of vehicles, and either for ocean or river navigation.

This vessel, as represented, was chiefly constructed of iron, having two separate hulls placed side by side, with a space between them in which the paddle-wheel worked, and strongly connected together at the deck (which passed over all), and also by a plate-iron arch and stays between the hulls. The hulls thus joined afforded a great extent of deck room with a very small amount of tonnage, or of resistance from the area passing through the fluid; and, as both ends were exactly similar, the vessel would sail with equal facility either way, it was expected, without turning. The keels and stems were not placed in the centre of the hulls, but situated towards the inside of them, thus making the water-lines very fine on the inside, to diminish the tendency of the water to gorge up between the hulls, found to take place in twin steamers as commonly constructed; which gorging up of the water tends to separate the two hulls and greatly increases the resistance in passing through the water. The inner bilges of the two hulls were much fuller

[87] A daughter of Hon. Wm. Pitt Preble, of Portland, Maine.

than the outer ones, to afford a greater degree of buoyancy on the inside, necessary in order to support the weight of the deck, etc., between the hulls. The vessel was represented as adapted for river navigation, at a high degree of velocity; but a vessel required for sea purposes would be made broader in proportion to her length, according to the trade in which she was to be placed.

The "Gemini" was one hundred and fifty-seven and a half feet long and twenty-six and a half feet broad on deck, each hull being eight and a half feet broad, with a space of nine and a half feet between them. Her frames were of angle-iron, and spaced, the outside plating being securely riveted to them. The keels were formed by curving the plates downwards, so as to form channels for the bilge-water inside of the hulls; but in sea-going and other vessels, where the draught of water would be greater, Mr. Borrie proposed keels of iron bars, and to rivet the garboard strakes upon them in the usual way. The plating was not carried to the top of the frames on the inside of the hulls, except at the space in the middle for the paddle-wheel, but was carried up to the deck, so as to form an arch between the two hulls, which were also bound together with iron stays at the springing of the arch. The deck-beams were of T-shaped iron, securely fastened at the ends to the frames, and at the middle to the top of the arch. The deck-planks were fixed to the beams by screws passing through the flanges of the beams, and calked and made water-tight in the usual way. Each of the hulls was divided into compartments by water-tight bulkheads. There were also fenders of angle-iron, one at each end, to prevent boats, etc., from getting into the canal or space between the hulls. The deck was bounded by bulwarks, which had two large gangways on each side, hinged at the lower side to the decks, and lifted up or lowered by winches attached to the bulwarks. On each end of the paddle-box were a number of deck-houses,—a cook-house, with apparatus in it for cooking by steam, a state-room, a dining-room, engineer's room, etc. On the top of the deck-houses and paddle-box was a platform, or hurricane-deck, upon which the steering-wheels were placed; and being properly railed in, could be used as a promenade for passengers.

The vessel having to sail with equal facility either way without turning, was fitted with a rudder at each end. The rudder was in the middle of the canal between the hulls, and was formed of an iron plate upon a shaft or spindle coming up to the deck, which shaft was not in the centre of the plate, but about one-third of its length from the one side, so that the pressure of the water against the rudder acted partly on both sides of its centre of motion; but when the rudder was left free it always accommodated itself to the direction of the vessel's motion, one end longer than the other from the centre of motion.

The steering-wheels were on the top of the paddle-box in the middle of the vessel; and thus the man at the wheel, from his elevated

position, had a clear view of all objects in the way of the vessel. The clear area on deck for passengers, including the hurricane-deck, above the accommodations at each end of the paddle-box, was about two thousand six hundred square feet, and the area of the cabin floors was about six hundred square feet, so that there was ample accommodation in the vessel to carry from eight hundred to one thousand passengers with ease and safety.

1851.—The screw steamship "Himalaya," which in the course of construction excited considerable interest, was launched on the anniversary of the queen's birthday, 1851. The launch was witnessed by the directors of the Peninsular and Oriental Company, for which the vessel was built, and a noble and fashionable assembly. The naming was by Lady Matheson, wife of Sir James Matheson, chairman of the company. On a given signal, shortly before high tide, the vessel glided gently into the water, amid the cheers of the spectators.

The "Himalaya," designed and built under the inspection of F. Wattman, Jr., at Blackwall, was commenced in November, 1850; her length between perpendiculars was three hundred and forty feet; breadth, forty-six feet two inches; depth of hold, thirty-four feet nine inches; and she was three thousand five hundred and fifty tons burden, and had engines of seven hundred horse-power. She was intended to have paddle-wheels, with engines of twelve hundred horse-power, but before she was too far advanced it was decided she should be fitted with a screw propeller and engines of seven hundred horse-power on the most approved principle. She carried twelve hundred tons of fuel, with accommodation for four hundred cabin passengers, five hundred tons measurement goods, and had ample space for mail-rooms, etc. In strength of build and form for speed, the "Himalaya" was at that day unrivaled, having six water-tight bulkheads, and she was fitted with every appliance for safety. She was provided with "Trotman's improved Porter's" anchors, the bower-anchors weighing respectively forty-eight and fifty hundredweight, in lieu of ordinary anchors of five tons each. The cabin arrangements with regard to ventilation were effective, and combined elegance with simplicity.

1852.—The magnificent side-wheel steamer "Francis Skiddy," which plied between New York and Albany in 1852, was built by George Colyer. She was three hundred and twenty-five feet in length, thirty-eight and a half feet beam, eleven and a half feet depth of hold. Her engine was of one beam, seventy-inch cylinder and fourteen-feet stroke. Her water-wheel was forty feet in diameter, twelve-feet face, thirty-three-inch bucket. She had four low-pressure boilers, twenty-four feet long, nine-feet face, capable of seventy pounds of steam, with a blowing-engine attached to each of twelve-inch cylinder and twelve-inch stroke. Her consumption of fuel was two thousand pounds per hour. Her draught of water, five and a half feet. As a provision

against danger, she had three fire-pumps,—two to work by hand and one by steam, with six hundred and fifty feet of hose attached, together with five buckets, a life-preserver for every passenger, and a supply of Francis's metallic life-boats, etc. Her appointments were magnificent. The main cabin, three hundred feet in length, was capable of seating five hundred people, and was arranged in the most commodious manner. There was also an immense saloon, opening upon sixty state-rooms. This was surmounted with a dome or arch, decorated with stained glass, which cost ten thousand dollars.

In 1852 the "Australian" was the first to make the mail steam voyage from England to Australia. She was built at Dumbarton, by Messrs. W. Drury & Brothers, for Messrs. Cunard & Co., for the Canadian trade. She left England on her first voyage June 5, 1852, and returned January 11, 1853, having completed the voyage in two hundred and twenty-one days, one hundred and sixty-five of which were under steam and sails, and fifty-six in port, taking in mails, coal, and lading. The following account of her voyage *out* is extracted from *Chambers' Journal* for 1854:

"The public mind was excited to a pitch of feverish anxiety concerning the gold discoveries in Australia, and in order to provide for the delivery of mails to and from the colony with greater speed and regularity, a company was formed, pledged to effect this by a line of great steamships. Even then, people who ought to have known better confidently predicted that direct steam communication with Australia was impracticable. As in the case of crossing the Atlantic, nothing would convince them, or settle the question, but actual performance. Now, as the distance to be run is little short of sixteen thousand miles, it is obvious that no ship, unless of enormous size, could carry sufficient fuel to perform the entire voyage under steam, without stopping to take in coal at stations on the way; and this has caused hitherto considerable delay and great additional expense. The pioneer was the 'Australian,' a large new Clyde-built iron steamship, that first started from London, and after some accidents and delays, finally left Plymouth with the mails on the 5th of June, 1852, under command of Captain Hoseason. She anchored at St. Vincent on the 16th to take in coal, which had previously been sent to the depot there from England. This occupied three days. The ship then proceeded on her voyage, and after coaling at St. Helena, reached the Cape of Good Hope on the 19th July, where she again coaled, sailing from Table Bay on the 22d, and anchored in King George's Sound, West Australia, on the 20th of August. There she received coal from a ship sent out with a cargo from England expressly for her, and a few days afterwards proceeded to Adelaide, which she reached on the 29th, and Melbourne on the 2d of September. This was the first voyage performed by a steamer from England to the antipodes. In some respects it was a badly-managed

voyage, much unpleasantness occurring among both passengers and crew, repeated accidents happening to the machinery, and the coal running short between the stations, so that at times the engines stopped, and the vessel had to lie to or proceed under canvas. Nevertheless, it effectually demonstrated the practicability of the enterprise. She was followed by the 'Great Britain,' and steamships now perform with punctuality and dispatch the voyage to and from Australia, calling at the Cape, both on the outward and homeward passage, to land and receive mails and passengers, equal to that which distinguishes the Atlantic and Mediterranean steamers. Taking into consideration the prodigious expanse of ocean to be traversed, this is a triumphant realization of the most sanguine hopes of those who have watched the progress of steam navigation."

The Peninsular and Oriental Company was the first to adopt screw steamers for its regular service. In 1852 the "Chusan," of seven hundred and sixty-five tons, and the "Formosa," of six hundred and seventy-five tons, were placed upon the route between Hong-Kong and Shanghai. These were succeeded by the "Bengal," of two thousand one hundred and eighty-five tons, and the "Candia," of nineteen hundred and eighty-two tons, between Suez and Calcutta.

A Parliamentary return showing the number of vessels of wood and iron belonging to British mail contract steam-packet companies, in March, 1853, was as follows:

Name of Company.	No. of Vessels.			Tonnage.			Horse-Power.		
	Wood.	Iron.	Total.	Wood.	Iron.	Total.	Wood.	Iron.	Total.
Peninsular and Oriental	11	22	33	11,800	26,449	38,249	4,086	7,481	11,567
Royal West India	19	1	20	32,612	2,700	35,312	8,750	800	9,550
British and North America	8	1	9	14,991	2,500	17,491	5,690	1,000	6,690
Pacific	...	8	8	.....	6,688	6,688	.....	2,298	2,298
General Screw Steam Shipping	...	8	8	.....	13,496	13,496	.....	2,250	2,250
Australian	...	5	5	.....	8,600	8,600	.....	1,800	1,800
Southwestern	...	4	4	.....	1,612	1,612	.....	677	677
African	...	4	4	.....	3,920	3,920	.....	530	530
Total	38	53	...	59,403	65,965	.....	18,526	16,836	.....
Grand total			91			125,368			35,362

This table will show at a glance the rapid increase of British ocean steam navigation in the fifteen years that had elapsed since the pioneer voyages across the Atlantic of the "Sirius" and "Great Western."

1853.—Messrs. Caird & Co. launched from their yard at Cartsdyke, in May, 1853, the Royal Mail iron paddle-steamer "Atrato." Early in 1852 the "Demerara," built on the Severn for the Royal Mail Steam-packet Company, was stranded across the river soon after her launch, and so much injured that she had to be broken up. For

this ship Messrs. Caird & Co. had the engines ready, and the directors immediately gave orders to construct an iron vessel to be fitted with them. That ship was the "Atrato." To suit the machinery it was requisite to maintain the same width as the "Demerara" had been, but the length was considerably increased. The "Great Britain" was of about thirty tons greater capacity, but the "Atrato" was longer by forty feet.

Her dimensions were:

Length over all	350 feet.
Length of keel and forerake	315 "
Extreme breadth, including wings	72 "
Breadth of beam	42 "
Depth of hold	34 "

The dimensions of the great war-steamer "Duke of Wellington," three-decker, may be stated, by way of comparison:

Extreme length	278 feet.
Length of keel and forerake	240 "
Breadth	59 "
Depth	24½ "

The "Duke" being thus less than the "Atrato" by about seventy feet in length and ten feet in depth; the width of the latter being, from the cause mentioned, less by seventeen feet. The height from keel to top of bulwark-rail was forty-three feet. Her bow was surmounted by a spirited representation of an Indian deity, the work of Mr. Peter Christie, of Greenock.

The "Atrato" had four decks, seven and eight feet respectively in height. The spar-deck was flush from stem to stern, affording a promenade the length and breadth of a good street,—three hundred and thirty feet by thirty-eight. She had two funnels and three masts. The standing rigging was light and graceful, being formed of galvanized iron. The masts were fitted with Sir Snow Harris's lightning conductors. The main- and foremasts were "great sticks" of Quebec pine, the former measuring ninety feet long by seven in circumference.

The keel of the ship was formed of nine enormous pieces of iron, and the stem and stern-posts were each one piece, and both carried besides some distance along horizontally. In the framing and fitting of the paddle-boxes, the beams and stringers, all of patent iron, presented an extraordinary contrast to the great logs used for the purpose in the other ships. The paddle-spaces were forty feet by twelve and a half wide, the wheels of thirty-seven feet diameter, patent feathering principle. The ship was divided into seven water-tight compartments by iron bulkheads. Thirteen hundred tons of iron were used in the construction of the hull. She was propelled by two beam-engines of

the collective power of eight hundred horses, and she had accommodations for two hundred and twenty-four first-class passengers.

July 17, 1853, the "Forforo," a small iron screw steamer of forty-three tons and forty horse-power, rigged as a three-masted schooner, sailed from Liverpool for the west coast of South America, and arrived at Valparaiso November 15. The passage occupied one hundred and twenty-one days,—forty-six under steam and sail, and twenty-eight under sail alone. She used in all one hundred and sixty tons of coal, and averaged six knots all the way. She was the smallest steamer that ever performed so long a voyage.

1854.—In 1854 the English screw-steamship "Argo," eighteen hundred and fifty tons register, returned to England from Australia *via* Cape Horn, being the first steamer that had circumnavigated the globe. She made the passage out to Australia in sixty-four days, and returned *via* Cape Horn in the same time. Since the ancient days of Jason and his "Golden Fleece," several celebrated ships have borne the renowned name of "Argo," and certainly we consider the present steamer not the least worthy of the number to be chronicled in history. She has proved herself one of the most notable pioneer ships of the nineteenth century.

1853–54.—In 1853 the American paddle-wheel steamer "Golden Age" came to Liverpool, where she attracted much notice. She was of great size and power, built with all the latest transatlantic fashions and improvements, one of which was that she literally had no bowsprit!—something our English brothers then thought—though they have learned to know better—as indispensable as the nose on a man's face. Her owners resolved to send her to Australia, and she made the quickest passage out on record, up to that time. But her subsequent voyage was far more memorable and important. On the 11th of May, 1854, she left Sydney, and in thirteen days reached Tahiti, where she took in the enormous weight of twelve hundred tons of coal. This occupied her six days; and on the 31st she sailed direct for the Isthmus of Panama, which she reached on the 19th of June, the passage from Sydney, including the long stoppage mentioned, thus being performed in about thirty-nine days! This wonderful feat was rendered more remarkable from strong head-winds during the first part of the voyage and an estimated current against her course equal to an extra seven hundred and sixty-eight miles. From Tahiti, however, the sea was so smooth and the passage so mild that a canoe might have come the whole distance in safety. She arrived at Panama just in time to transfer two hundred passengers, her mails, and a million sterling in gold to the West Indian steamer "Magdalena," at Chagres, and consequently letters from Sydney to the 11th, and from Melbourne to the 5th, of May—only sixty-seven days from Sydney!—were received in London on the 18th of July, 1854.

"Thus to American skill and enterprise," says the *Edinburgh Jour-*

nal, "credit is due for first opening direct steam-communication across the vast Pacific, in that manner connecting Australia and Europe by the medium of Panama. We cannot read without regret that the spirited proprietors of the 'Golden Age' have incurred a dead loss of several thousand pounds by the experiment, solely owing to the cost of coal at Tahiti. But they have shown what can be done, and nothing can be more certain than that ere long arrangements will be made sufficiently economical to enable a regular line of noble steamships to traverse this novel route, and so bring us within two months' distance of Australia. To quote a newspaper paragraph, 'Ever since Columbus set out across the Atlantic in search of India, it has been the dream of commerce to reach the East by the West, and from the time that Balboa caught a glimpse of the great trans-American ocean from the heights of Darien the world has looked forward to the junction of the two oceans at one point or another as the commencement of a new era in the history of commerce. Nevertheless, the Pacific has hitherto been a field of adventure rather than of regular commerce. Till recently it has been cut off from all direct communication with the trade and civilization of Europe and America. No maritime nations of importance have occupied any part of the extensive line of coast by which it is circumscribed, and within which it has lain in silent repose rather like a secluded lake than a mighty ocean. But a new destiny is beginning to dawn upon it. The "Golden Age" breaks in upon its isolation, and arouses it from its slumbers. She inaugurates an era in which its commerce will probably as far transcend that of the Atlantic as the latter eclipsed that of the Mediterranean.'"

1855.—On the 3d of March, the steamship "Persia," the first *iron* paddle-wheel ship built for the Cunard Company, was launched from the building-yard of Messrs. Robert Napier & Sons, at Govan. This was the largest steamship then afloat in the world, exceeding in length, strength, tonnage, and steam-power the "Great Britain" or the "Himalaya," and also, by twelve hundred tons, the internal capacity of the largest of the Cunard liners of that time. Her chief proportions were as follows:

Length from figure-head to taffrail	390 feet.
Length in the water	360 "
Breadth of the hull	45 "
Breadth all over	71 "
Depth	32 "

The lines of beauty had been so well worked out in the "Persia" that her appearance was singularly graceful and light. Yet the mighty fabric, so beautiful as a whole, was made up of innumerable pieces of metal, welded, jointed, and riveted into each other with exceeding deftness. The keel consisted of several bars of iron about thirty-five

feet in length, each joined by long scarfs, and as a whole thirteen inches deep by four and a half inches thick. The framing was constructed in a peculiar manner to secure the greatest amount of strength. The iron stern-post was thirteen inches in breadth by five inches in thickness, carrying the rudder, the stock of which was eight inches in diameter. The framing of the ship was very heavy. The space between each frame was only ten inches, and the powerful frames or ribs were themselves ten inches deep, with double angle-irons at the outer and inner edges.

The plates, or outer planking of the ship, were laid alternately, so that one added strength to the other, forming a whole of wonderful compactness and solidity. The keel-plates were eleven-sixteenths of an inch in thickness; at the bottom of the ship the plates were fifteen-sixteenths of an inch in thickness; from that section to the load water-line they were three-fourths of an inch; and above that they were eleven-sixteenths of an inch in thickness. The plates round the gunwales were seven-eighths of an inch in thickness.

She had seven water-tight compartments. The goods were to be stowed in two of the divisions. The goods store-rooms or tanks were placed in the centre line of the ship, with the coal-bunkers on each side of them. The vessel was constructed with a double bottom under the goods chambers, so that if the outer were beat in, the inner would protect the cargo dry and intact. The chambers were water-tight, and in the event of accident to the hull the tanks would of themselves float the ship.[56]

1856.—By a statement in Lardner's "Museum of Science and

[56] In a lecture delivered in England by Mr. William Pearce, of the great ship-building firm of John Elde & Co., on the Clyde, he presented a very forcible illustration of the advance of steam navigation during the last quarter of a century.

He took as a type of the vessels the "Persia," which twenty years ago was the crack boat in the Cunard service, and was sought for, on account of size and speed, by all who contemplated transatlantic voyage. Mr. Pearce pointed out that the highest rate of speed of the "Persia" was thirteen knots an hour, and that in a passage across the Atlantic she consumed six and one-third tons of coal for every ton of cargo she could carry. In opposition to the "Persia" he placed the "Gallia," of the Cunard Line, and the "Arizona," of the Guion Line, as instances of what had been done. The speed that the "Gallia" has made on a transatlantic voyage is fifteen and one-half knots per hour, at a consumption of one-half a ton of coal for every ton of cargo on board. A still more favorable exhibit had been made by the "Arizona," which had made voyages at the rate of sixteen and one-quarter knots to the hour, with a consumption of only four hundred and fifty pounds of coal for each ton of cargo in her hold. To bring the comparison down to a simple ratio, a ton of cargo had been transported across the Atlantic by the "Arizona" at less than one-thirtieth the outlay in coal required when the same service was performed by the "Persia," and at a greater degree of speed. But this was by no means all the saving, for by this decrease in consumption the number of coal-heavers and firemen employed had been materially reduced. These savings have been largely due to improved machinery, and the progress in the construction of hulls had not advanced in anything approaching a similar proportion.

Art," it appears that on the 1st of April, 1856, the steam vessels belonging to the Royal Navy were:

	Guns.	Horse-Power.
48 line-of-battle ships	3797	22,950
24 frigates and mortar vessels	889	10,560
90 paddle-wheel vessels	500	24,640
76 corvettes and sloops	761	16,202
47 troop-ships	87	7,300
155 gunboats	580	8,240
435	6564	89,892

1858.—*The "Great Eastern."*—Experience had shown that a sea-steamer of eighteen hundred tons, making the quickest passages to and from England and Australia, with a full cargo and complement of passengers, lost by the voyage from one thousand to ten thousand pounds. A great portion of the expense was from the necessity of supplying coal depots at different points where the steamer could touch during her voyage. These deviations from the shortest route protracted the passage so that clipper-ships made as quick passages as steamers, and at such less expense that they superseded steamers. The problem then to be solved was: Supposing a steamer could be built to move eighteen miles an hour, what ought to be the size of a steamer which could carry out and back fuel for a voyage from England to Australia,—twenty-five thousand miles? To work a steamer profitably it was found that the tonnage must be nearly a ton to a mile. Mr. Brunel, therefore, conceived the idea of constructing a steamer of from twenty to twenty-five thousand tons burden, capable of carrying coals for full steaming on the longest voyage, to be built on the tubular plan, with the screw, the paddle, and also fitted with sail for propelling power. The Eastern Steam Navigation Company was formed with a capital of one million two hundred thousand pounds, in shares of twenty pounds each, with power to increase the capital to two million pounds. The place where she was to be built, on the bank of the Thames at Millwall, consisting of a layer of mud thirty feet thick on a bed of gravel, was prepared by driving more than fourteen hundred piles in lines parallel to the river, as the vessel was to be launched *sideways*. The first plate of the vessel was laid May 1, 1854.

The ship consists of two skins,—an inner and outer skin,—two feet ten inches apart, with longitudinal webs at intervals of six feet running the whole length of the vessel; and these subdivided by transverse plates into water-tight spaces of about six feet square, so that should the outer skin be damaged the water could only get in between the webs and inner skin. The ship is divided by transverse bulkheads into twelve water-tight compartments below the lower deck, and nine above the lower deck, so that should both the outer and inner skin be fractured

the water could only enter one of these compartments,—two of which could be filled without danger to the safety of the vessel. Besides these transverse bulkheads there are two which extend from the bottom of the ship to the upper deck, and run longitudinally for a length of three hundred and fifty feet. There are also two tubular iron platforms extending from the gunwale to the longitudinal bulkheads, running fore and aft, thirty-six feet apart, and connected together about every sixty feet by iron platforms seven feet wide. The greatest care was taken to make the bow strong enough to resist any impediment, and to enable the vessel to resist the constant vibration of the screw.

The vessel has no keel, the bottom being flat. A keel-plate was first laid along a level platform prepared for it about five feet from the ground; then the centre-web, which somewhat resembles the keel of an ordinary ship.

The iron plates of which the skins of the vessel are composed are three-quarters of an inch thick, except the keel-plate, which is one inch thick. Their average size is about ten feet by two feet nine inches, and their weight eight hundred and twenty-five pounds. For the stern-post and keel some enormous plates were required. Two were twenty-seven feet long, three feet three inches wide, one and one-quarter inches thick, and weighed two tons each; others were twenty-five feet long, four feet wide, and one and one-quarter inches thick, and weighed two and one-quarter tons each. About thirty thousand plates, of an average weight of six hundred pounds each, were used in the construction of the hull. Each plate, before being placed in its proper position, was a separate study to the engineer. For each a model in wood was made, and by steam-shears the plates were cut according to the pattern; the proper curve was given to it, and the holes for the rivets were punched by machinery. They were riveted together by rivets, fastened at a white heat, some seven-eighths of an inch and some three-quarters of an inch in diameter, about two and a half inches apart where the plates were to be made water-tight, and from four to six inches apart in other places. The total number of rivets was not far from two million. About eight thousand tons of iron were used in her hull.

The estimated weight of the whole vessel when voyaging with every article and person on board was twenty-five thousand tons.

For the purpose of launching the vessel two ways were constructed, with pile foundations, one at the fore part of the vessel and one at the after part, each three hundred feet long and one hundred and twenty feet wide, with about one hundred and twenty feet of space between them. The cradles, two in number, were of the same width as the ways. Their bottom was composed of iron plates seven inches wide and one inch thick, placed at intervals of one foot apart, with their edges carefully rounded off so as to offer the least resistance to the railway metals of the ways down which they would pass.

The first attempt to launch the vessel was made November 3, 1857, and the vessel was moved six feet down in her ways. Several other unsuccessful attempts were made on different days, until at length, January 31, 1858, she was afloat. The cost of building and launching the vessel in round numbers was seven hundred and thirty thousand pounds, exceeding the original estimate by two hundred and thirty thousand pounds. In November, 1858, the Eastern Steam Navigation Company, finding it impossible to go on, was dissolved, and a new corporation, called "The Great Ship Company," was formed, with a capital of three hundred and thirty thousand pounds. Of this capital, one hundred and sixty thousand pounds was to be paid to shareholders of the former corporation, the fitting and finishing would cost about one hundred and twenty thousand pounds, so that it was estimated fifty thousand pounds would be left for working expenses.

SUMMARY OF STATISTICS OF THE "GREAT EASTERN."

Length of upper deck	692 feet.
Length between perpendiculars	680 "
Breadth across paddle-boxes	118 "
Breadth of hull	83 "
Depth from deck to keel	58 "
Number of decks	4
Number of masts	6
Diameter of masts	2 feet 9 inches to 3 " 6 "
Quantity of canvas under full sail	6,500 square yards.
Number of anchors	10
Number of boats	20
Tonnage (old measurement)	22,500 tons.
Storage for cargo	6,000 "
Capacity of coal-bunkers	12,000 "
Draught of water, unladen	15 feet 6 inches.
Draught of water, laden	30 feet.
Number of water-tight compartments	12

Paddle-Wheels.

Diameter of paddle-wheels	56 feet.
Weight of "	185 tons.
Length of floats	18 feet.
Width of "	8 "
Number of floats to each wheel	30
Length of paddle-shafts	38 feet.
Weight of "	30 tons.
Length of intermediate cranked shaft	21½ feet.
Weight of " " "	31 tons.

Paddle-Engines.

Nominal horse-power	1,000
Number of cylinders	4
Diameter of "	6 feet 2 inches.
Weight of cylinders, including piston and rod	38 tons.
Length of stroke	14 feet.
Strokes per minute	14

Paddle-Engine Boilers.

Number of boilers	4
Furnaces to each	10
Length of boilers	17 feet 6 inches.
Width of "	17 " 9 "
Height of "	13 " 9 "
Weight of each	50 tons.
Weight of water	40 "
Area of heating surface	4,800 square feet.
Number of tubes	400
Thickness of plates	$\frac{3}{8}$ and $\frac{7}{16}$ inches.

Screw-Propeller.

Diameter of screw	24 feet.
Pitch of screw	37 "
Number of fans	4
Weight of screw	36 tons.
Length of propeller-shaft	160 feet.

Screw-Engines.

Nominal horse-power	1,600
Number of cylinders	4
Diameter of each cylinder	84 inches.
Length of stroke	4 feet.
Number of revolutions per minute	50

Screw-Boilers.

Number of boilers	6
Funnels to each boiler	12
Length of boiler	18 feet 6 inches.
Width of "	17 " 6 "
Height of "	14 feet.
Weight of "	57 tons.
Weight of water	45 "
Area of heating surface	5,000 square feet.
Number of tubes	420
Thickness of plates	$\frac{7}{16}$ and $\frac{1}{2}$ inches.
Number of auxiliary engines	4
Number of donkey-engines	10
Total horse-power, about	12,000

Passenger Accommodation.

Number of passengers (first-class)	800
" " (second-class)	2,000
" " (third-class)	1,200
Aggregate length of saloons and berths	350 feet.
Number of saloons	10
Length of principal saloon	100 feet.
Width	36 "
Height	13 "
Length of berths	14 "
Width of "	7 to 8 feet.
Height of "	7 feet 4 inches.

Nothing can stand comparison with Mr. Scott Russell's great steamship except Noah's ark; even Noah's ark could not match it. The length of the ark was three hundred cubits, its breadth fifty cubits, and its height thirty cubits. The Scripture "cubit," as stated by Sir Isaac Newton, is twenty inches and about sixty-two hundredths. Bishop Wilkins makes it somewhat more,—namely, twenty-one inches and about sixty-eight hundredths. Reducing these to English feet, and calculating the tonnage after the old law, we have approximately the following table:

	Noah's Ark according to Sir Isaac Newton.	Noah's Ark according to Bishop Wilkins.	Great Eastern.
Length between perpendiculars	515.62	547.00	680.00
Breadth	85.94	91.16	83.00
Depth	51.56	54.70	58.00
Keel or length for tonnage	464.08	492.31	630.02
Tonnage according to old law	18,232	21,762	28,098

So Noah's ark is quite overshadowed. Magnitude is not, however, the only peculiarity which the "Great Eastern" possessed. No other vessel afloat had two sets of engines and two propellers, nor was the cellular construction to be found elsewhere in marine architecture.

To comprehend the immense size of the ship one must go on the main deck. From that stand-point every foot of the deck is seen except the very shadow of the masts and chimneys. The wave of the hand can be seen by the steersman or any officer on watch on any part of the deck. Go on to the bridge between the paddle-boxes and look towards the bow, and you see a space and extent equal to the entire length of a very large steamer,—near two hundred and fifty feet,—and then turn your eye towards the stern and you have double the distance in that direction, the entire length of the deck being a little short of seven hundred feet, and the width eighty-four feet. This expanse of deck covers about an acre of surface, or one hundred and sixty square rods, stretched out into a long oval one-eighth of a mile, or forty rods in length. The deck of the ship is double, or cellular, after the plan of the Britannia tubular bridge, and is formed of two half-inch plates at the bottom and two half-inch plates at the top, between which are webs which run the whole length of the ship.

This deck is planned to be of such strength that were it taken up by its two extremities and the entire weight the vessel is to carry were hung upon its middle, it would sustain the whole unaided.

The deck is six hundred and ninety-two feet in length, or more than as long again as that of the steamship "Great Britain." It is nearly three times as long as that of the British line-of-battle ship the "Duke of Wellington"; eighty-eight feet more would make it as long again as the "Persia," the longest vessel, previous to the launch of the "Great Eastern," afloat upon the ocean.

"This ship," says a writer just after the launch, "is one of the wonders of this fast age, but whether, like some of the monstrosities of past ages, she is to be a mere curiosity and a monument of the folly of her builders, or whether she is to introduce a new age of progress in steam navigation, yet remains to be demonstrated. The first step in the solution of the problem is her safe and rapid passage from England to America."

"Granting, then," said the *Liverpool Albion*, just previous to her launch, "that the mammoth ship is merely an extended copy of all other iron steamers built on the wave-line principle, let us see what are the 'one or two exceptions' so modestly alluded to by Mr. Russell last week before the British Association of Dublin. The most prominent in reality, though the feature which escapes unprofessional visitors, is the cellular construction of the upper deck and the lower part of the hull, up to the water-line, or about thirty feet from the bottom, which is as flat as the floor of the room. This system, while it gives greater buoyancy to the hull, increases her strength enormously, and thus enables her to resist almost any outward pressure. Two walls of iron, about sixty feet high, divide her longitudinally into three parts,—the inner containing the boilers, the engine-rooms and the saloons, rising one above the other, and the lateral divisions the coal-bunkers; and above them the side cabins and berths. The saloons are nearly sixty feet in length, the principal one nearly half the width of the vessel, and lighted by skylights from the upper deck. On either side are the cabins and berths, those of the first-class being commodious rooms large enough to contain every requirement of the most fastidious landsmen. The thickness of the lower deck will prevent any sound from the engine-rooms reaching the passengers, and the vibrations from being at all felt by them. Each side of the engine-rooms is a tunnel through which the steam- and water-pipes will be carried, and also rails for economizing labor in conveyance of coal. The berths of the crew are forward, below the forecastle, which it is intended to appropriate to the officers.

"Below the berths of the seamen are two enormous cavities for cargo, of which five thousand tons can be carried, besides coals enough for the voyage to Australia, making about as many tons more.

"The weight of this huge ship being twelve thousand tons, and coal and cargo about eighteen thousand tons more, the motive-power to propel her twenty miles an hour must be proportionate. If the visitor walks aft and looks down a deep chasm near the stern, he will perceive an enormous metal shaft one hundred and sixty feet in length and weighing sixty tons; this extends from the engine-room nearest the stern to the extremity of the ship, and is destined to move the screw, the four fans of which are of proportionate weight and dimensions. If next he walks forward and looks over the side, he will see a paddle-

wheel considerably larger than the circle at Astley's; and when he learns that this wheel and its fellow will be driven by four engines, having a nominal power of one thousand horses, and the screw by a nominal power of sixteen hundred horses, he will have no difficulty in conceiving a voyage to America in seven, and Australia in thirty-five, days.

"The screw-engines, designed and manufactured by Messrs. J. Watt & Co., are the largest ever constructed, and when making fifty revolutions per minute will exert an effective force of not less than eight thousand horses. It is difficult to realize the work which this gigantic force would perform if applied to the ordinary operations of commerce: it would raise one hundred and thirty-two thousand gallons of water to the top of the Monument in one minute, or drive the machinery of forty of the largest cotton-mills in Manchester, giving employment to from thirty to forty thousand operatives.

"There are four cylinders, each about twenty-five tons, and eighty-four inches in diameter. The crank-shaft, to which the connecting-rods are applied, weighs about thirty tons. The boilers are six in number, having seventy-two furnaces, and an absorbent heating surface nearly equal in extent to an acre of ground. The total weight exceeds twelve hundred tons, yet so contrived that they can be set in motion or stopped by a single hand.

"Sails will not be much needed, for in careering over the Atlantic at twenty miles per hour, with a moderate wind, they would rather impede than aid; but in the event of a strong wind arising, going twenty-five miles per hour in the course of the vessel, sails may be used with advantage. The 'Great Eastern' is provided, accordingly, with seven masts, two square-rigged, the others carrying fore and aft sails only. The larger masts are iron tubes, the smaller of wood. The funnels, of which there will be five alternating with the masts, are constructed with double castings, and the space between the outer and inner casting will be filled with water, which will answer the double purpose of preventing the radiation of heat to the decks and economizing coal by causing the water to enter the boiler in a warm state. Her rigging will probably cause most disturbance of ideas to nautical observers, for, besides the unusual number of masts, she will want two most striking features of all other vessels, namely, bowsprit and figure-head. Another peculiarity is the absence of a poop. The captain's apartment is placed amidships, immediately below the bridge, whence the electric telegraph will flash the commander's orders to the engineer below, helmsman at the wheel, and lookout man at the bows. In iron vessels, great precaution being necessary to prevent the compass from being influenced by the mass of metal in such attractive proximity, various experiments have been made with the view of discovering the best mode of overcoming this. It was originally intended to locate the compass upon a

stage forty feet high, but this plan has been abandoned, and a standard compass will be affixed to the mizzen-mast at an elevation beyond the magnetic influence of the ship.

"Whatever misgivings may be felt as to the length and the weight she will carry amidships will be set at rest before she even touches the water by the mode of launching, an operation as great a novelty as the ship herself. The plan hitherto has been to build the vessel on an inclined plane, and at right angles with the water; but in case of the 'Great Eastern' this was impossible, on account of her great length, to say nothing of the expense of building a vessel of her enormous dimensions in a position which would elevate her forecastle nearly a hundred feet above the ground. These considerations led Mr. Brunel to determine upon launching her sideways, with which view she has been built parallel with the river. In constructing the foundation of the floor upon which it stands provision has been made at two points to insure sufficient strength to bear the whole weight when completed. On these two points she will rest when ready, and thus her strength will be tested in the severest and therefore most satisfactory manner. Two cradles will be introduced at these points, and she will then be moved by two hydraulic engines. Timber ways are laid down to low-water mark, with an incline of one foot in twelve, and iron rails of peculiar construction are to be laid upon these transversely. A tell-tale will indicate the rate at which the two ends are descending, and any difference that may occur will be immediately rectified by strong check-tackles. It is calculated that she will advance twelve feet per minute, at which speed her submersion will be effected in twenty minutes. The cradles will then be drawn from under her, and she will be towed over to the opposite side of the river, where she will lie until ready for sea."

The London *Times*, after describing the big ship, thus discourses concerning her:

"With these principal figures, then, gone through, let us imagine the 'Great Eastern' afloat and on her road to Bombay or Melbourne, and with her ordinary complement of passengers on board. The first idea that strikes us is the multitude of faces on board. It will, in fact, be a whole town afloat, and much more than a town of four thousand population, because it will be a floating town of four thousand grown-up persons, at least with comparatively few exceptions, each of them being what is called an 'individual,'—by which we mean a human being of size to command notice, and having, to appearance at least, a mind and will of his own, together with a formed air, tone, and manner peculiar to himself. In this sense even young ladies are individuals. All this crowd of individuals will be collected within the dimensions of seven hundred feet by sixty. What a new shape of human society! Take the eight hundred first-class passengers by themselves, and what room does even this number afford for the formation of all kinds of different

circles and sets, which will know nothing of each other, one man only knowing another by sight, and hardly that! How many immeasurable social charms will be collected within a few hundred feet! How many Mr. Smiths will there be who will not speak to Mr. Jones during the whole voyage because he is not in the same set! How many Mr. Joneses will pay back Mr. Smith in the same coin! Between how many 'nice' young ladies and 'proper' young gentlemen will there not be a great gulf fixed, because in the eyes of anxious mothers the said young gentlemen are not desirable persons, but mere penniless bipeds! What flirtations will there not be behind boats, what rivalries, and, if many Americans voyage by the 'Great Eastern,' what duelings may we not expect on that ample deck! · In short, what an epitome or camera obscura of the world will the 'Great Eastern' present! It will be worth any aspiring novelist's while to take his berth to Australia or India and back again, simply for the great convenience of having so much human nature brought before him within so small a compass. It will be the mountain brought to Mahomet, the world condensing itself before his eyes for the sake of being observed and examined; the rapid succession of faces will bewilder him at first, but individuality will come out in time, though he must be sharp about his work, otherwise the 'Great Eastern' will have stopped her screw and paddles before he has got any results. If his material is enlarged his time is much curtailed on the new system. Farewell to long voyages with their appropriate quarrels and matches, their love-makings, reconciliations, and irrevocable unions; voyage-life has entered on another phase. For what is a month? It is gone before we begin to think about its going. How will the old voyagers look back to the romantic days when a roomful of persons were their own company for four months, gradually forming enmities or friendships, when attachments rose up among 'young people' unconsciously, and by the mere passive influence of the scene! We are growing a busier nation every year, and cannot afford time for more than one chapter of this sea romance."

After hopes deferred, and delays almost innumerable, the mammoth steamship "Great Eastern" made a highly successful trip across the Atlantic, and moored at the dock prepared for it in New York.

The event marks an era in the history of steam navigation. That a vessel so monstrous in its proportions—by the side of which the first steamer of Fulton would be but a cock-boat—should have been propelled across the ocean by the power of steam alone, shows what strides have been made since 1818, when the little American steamer "Savannah" ventured to cross the Atlantic, steaming when the wind was not fair, and sailing with favoring gales.

The "Great Eastern" differs from all ships which have been built before it in three respects, the chief of which is its excessive magnitude. Nothing like it ever before floated. We have given the figures of

her huge dimensions, but these naked numerals convey but a vague idea.

The immense steamships in the English and American navy hardly equal half her length or breadth, and yet such vessels as the "Himalaya," the "Persia," the "Adriatic," and the "Niagara" were previously regarded as absolute prodigies in marine architecture.

The "Great Eastern" had thirty-eight passengers and eight guests on her first voyage to the United States. Their names are as follows: Miss Herburt, Mr. and Mrs. Gooch, Mr. and Mrs. Stainthorp, General Watkins, Lieutenant-Colonel Harrison, Captain Morris, R.N., Captain McKennan, R.N., Major Balfour, Captain Drummond, Captain Carnagee,[89] R.N., Rev. Mr. Southey, Mr. A. Woods, correspondent London *Times*, Mr. J. S. Oakford, London, agent Vanderbilt Line, Mr. Murphy, New York pilot, Mr. Russell, Zerah Colburn, Mr. Holly, correspondent New York *Times*, H. M. Wells, Mr. McKenzie, G. S. Roebuck, Mr. Skinner, D. Kinnedy, G. E. M. Taylor, G. D. Brooks, Mr. Taylor, T. Harnley, H. Marin, Mr. Cave, A. Zuravelloff, Mr. Merrifield, Mr. Field, Mr. Barber, R. Marson, G. Hawkins, H. Cangtan, W. T. Stimpson, Mr. Beresford, Mr. Hubbard, George Wilkes.

OFFICIAL RUN OF THE "GREAT EASTERN."

June 18,	lat. 49° 27′,	lon. 8° 45′;	run since yesterday,		285	miles.
" 19,	" 48° 41′,	" 16° 12′	"	"	296	"
" 20,	" 47° 40′,	" 27° 54′	"	"	276	"
" 21,	" 46° 16′,	" 30° 08′	"	"	304	"
" 22,	" 44° 50′,	" 56° 22′	"	"	280	"
" 23,	" 42° 50′,	" 42° 40′	"	"	302	"
" 24,	" 41° 01′,	" 48° 52′	"	"	299	"
" 25,	" 40° 58′,	" 56° 10′	"	"	325	"
" 26,	" 40° 58′,	" 63° 41′	"	"	333	"
" 27,	" 40° 13′,	" 68° 56′	"	"	254	"
" 28,	" 40° 28′,	" 74° 00′	"	"	234	"
Total					3188	"

The New York *Herald* gave a lengthy account of the trip, from which we extract a few passages:

"THE START.—The 'Great Eastern' was advertised to sail on Saturday, the 16th of June. Workmen were engaged on her up to five o'clock in the afternoon of that day, and before they could be disembarked, the weather, which had been stormy since noon, became thick and hazy, so that it was felt by the pilot that it would be dangerous to attempt taking so large a vessel through the intricate channel of the Solent in the uncertain light of the evening. She lay, therefore, at her moorings, in Southampton water, till Sunday morning. About seven o'clock orders were given to unshackle the mooring-chains. Such is the

[89] Captain Carnagee and Mr. Gooch are directors in the Great Ship Company, and Mr. Russell is a son of J. Scott Russell, architect of the ship.

ponderous character of these cables, that it was some forty-five minutes before this could be effected.

"The morning was raw and gusty, with the wind blowing down the water. The tide had canted the high vessel athwart the channel, which she appeared to half block up, but on hoisting the fore-staysail she slowly paid off and got her head pointed in the direction she was to go. Steam was admitted into the cylinders of the paddle-engines about ten minutes past eight; shortly after the order was given, 'Easy ahead with the screw,' and the 'Great Eastern' steamed slowly out on her first voyage to sea. It has been a matter of remark in all the trials, that no motion whatever is felt when the ship is under way. It was not until the objects on shore began to recede that one could realize the fact of the huge ship being fairly on her journey. A few minutes' steaming brought us abreast of Calshot Castle, where the colors were dipped in acknowledgment of a similar courtesy from the fort. With this exception our departure was ungreeted. The men on board the few vessels we saw had seen so much of the big ship that she excited no emotion in their minds, and we passed without a single cheer. The ship rounded the bell-buoy and ran into the Solent with the handiness of a yacht. As we passed Yarmouth our presence was acknowledged by lowering the ensign of the Yacht Club-House, a civility duly returned by the ship. In two hours from starting we were abreast of the Needles. At twenty minutes past ten o'clock we discharged our Southampton pilot, Mr. Bowyer. In a few minutes we again got under way, with the screw making twenty-seven and the paddles about seven and a half revolutions per minute, and ran down channel. The ship on starting drew twenty-two feet of water forward and twenty-six aft. Her right trim is on an even keel, so that her condition was rather unfavorable to her best performance. She had five thousand five hundred tons of coal in the bunkers. Being stored principally aft, this had something to do with her being down by the stern. The object of the trip was not to attempt to get any great amount of speed out of the ship, but to get the machinery and men in good working order.

"The 'Great Eastern' so outrages all generally-received notions of ship- and of sea-life, that when in strolling about one of her spacious unoccupied lower decks a party of English and American gentlemen are discovered in an odd corner engaged in a great international skittle-match, one accepts it as a matter of course, and is thereupon fully prepared to find a billiard-table in full blast in some other unexplored compartment of the vessel. It is certainly the first time skittles were ever played in crossing the Atlantic, but the idea is a good one, as enabling those who are fond of athletic sports to divert the tedium of a sea-passage by first-rate physical exercise. Several exciting foot-races have come off round our ample deck, and the distance to be run in

making the complete circuit has been found quite sufficient to give the competitors a very decided 'breathing.'

"For those whose tastes do not lie in the direction of gymnastics there is a well-selected library of the English classics, which the accommodations of the saloons enable one to enjoy most luxuriously. Quite an interesting feature in our trip has been evening concerts in the ladies' saloons. Mr. Macfarlane, the conductor, and an able pianist of the ship's band have added much to the general enjoyment by the excellent manner in which they have rendered a popular selection of music arranged as duets for the piano-forte and the cornet-a-piston. Vocal amateurs among the officers and passengers have varied the performance by their efforts, and Captain Hall has shown that to his other accomplishments must be added that of being an excellent musician, his proficiency on the flute being very seldom equaled by amateurs.

"Thursday, June 28.—Ran under easy steam all night, and at twenty-five minutes past seven o'clock (ship's time) this morning reached the light-ship at Sandy Hook, thus making the run, in spite of the long route taken, the loss of time by encountering the Gulf Stream, and the delay from fogs, in eleven days two hours, including the difference of time. The distance run by the ship was three thousand two hundred and forty-two miles; deducting the loss of time by the fog, this gives a speed of about thirteen knots, proving that with a clear bottom and full pressure of steam she would overrun Brunel's estimate of fourteen and a half knots an hour for a long run.

"Though the passage was, all things considered, decidedly fine, it was still sufficiently checkered to settle the important point of the 'Great Eastern' being the most comfortable passenger-ship in the world. Her movements in a sea-way are so long, slight, and easy that no inconvenience is produced. Sea-sickness may be considered as annihilated, and all the attendant discomfort of a sea-passage reduced to a minimum."

Mr. George Wilkes, editor of *Wilkes' Spirit of the Times*, a passenger on the "Great Eastern," has furnished a graphic account of his trip. The getting on board and the first day of the voyage he makes of but little account, but after a night on board he writes as follows:

"Monday, June 18.—I was awoke this morning by the sun shining brightly through my port-hole (I should rather use the plural, for my sumptuous apartment was lit by two), and I rose to enjoy the luxury of dressing in a carpeted space as large almost as a room in the St. Nicholas. Before I got up, however, I lay for a few minutes to observe the silence and quiet of the vessel. In fact, there seemed to be no motion to her at all, and had it not been for the barely perceptible buzz of her bow—to which I was very near—as it split the water and passed it humming along the vessel's beautiful wave-line, I should have not been able to decide with certainty whether she was going on or standing still. Vibration there was none, and as for the usual clatter of machinery, which is the distinguishing feature of a steamship, it could not be heard at all. Moreover, there was not any of the squeak-

ing and squealing of timbers and tortured wood-work, which makes up a hideous serenade on all other vessels, for our party-walls, our state-room floors and ceilings, are of iron, and so ribbed and morticed, and joined stiffly with the hull, that the ship, while passing through still water, seems to be one solid tube or beam. Indeed, I could not make it certain to my senses that she had not stopped, until, looking out of my port-hole, I saw the ocean passing by, and our vast mass moving gradually through it like a floating castle. When I went on deck I found the air cool and bracing, but all there was of wind was caused by our own motion. At eight o'clock her paddle-engines gave ten revolutions, and those for the propeller twenty-nine, while the log, which was heaved a few minutes afterwards, credited her with a rate of ten knots. After timing the stroke of the engines I took a look at the rapidly-revolving paddles, and found that their original diameter of fifty-six feet, which had proved to be too large, had been reduced to fifty feet by reefing or drawing in the floats, or paddles, three feet on each arm. A large projection of useless iron consequently extends beyond the actual wheels to make an unnecessary resistance to the water, and I am told that the wheel would do better still if the floats were reefed in yet farther.

"I now took my first promenade around the deck, and though well instructed in its vast proportions, I could not help wondering, as I went on, to see the space unroll before me as it did. Standing at the stern and looking forward, the vessel seems almost to terminate amidships, but when you reach that point there appears to open up another ship before you. This illusion proceeds from the fact that two large life-boats, which had hung outside towards the bow, had been brought in at the request of the Board of Trade, and set on blocks in the centre of the ship to divide the view. These, however, will be removed as soon as the vessel gets into port, and then there will be restored a clean, unobstructed double avenue, through which our friend Hiram Woodruff might drive a double team, and go only four times round to make a mile. The deck is flush from stem to stern, and its only obstructions are the six masts, the five smoke-funnels in between, the raised sky-lights for cabin ventilation, and seven low structures, all of which run in a line with the masts and smoke-stacks. The two outermost of these—stem and stern—are sheds for the donkey or auxiliary engines; two are erections for the main cabin entrances; one spacious one in the centre of the quarter-deck is allotted to the captain; another of like character is the double residence of the first and second officers, and another still, of tolerable size, is given to the passengers as a smoking-room. These are the only obstructions which are found on deck, while around them runs a clean twelve-foot promenade, one side of which has been named Broadway and the other Fifth Avenue. The floor of the deck, like the hull of the ship, is of iron, and built like the sides, on the tubular principle, with twenty-one inches of space between its walls, and interlaced and strapped, crossed and recrossed, with welded bars, so as to give it not only the buoyancy of a life-preserver, but almost incalculable strength. The facing of this floor is pine. Two men are usually placed at each of the wheels, so that eight are enabled to steer her; and four auxiliary wheels can be added, by which a force of thirty-two men can be brought to bear. Only four, however, are now guiding her through the calm, mild weather of the morning. The course is given by the first officer, the man next the compass guides the motions of the rest; and if the direction of the ship requires a sudden change, an auxiliary compass, or indicator, which receives its impulse from the central bridge, directs them immediately what to do. But for this device it would be difficult to guide the ship without great loss of time; but now orders are communicated from end to end with the speed of light, and the leviathan answers to her rudder and points its nose as readily as if drawn with a hook, 'or led' by its tongue with a cord.

"At noon, as the bugle summoned us to lunch, I timed the paddle-piston at ten revolutions and the propeller at thirty and a half, and the log at the same time reported twelve and a half knots. The run of the ship for the last twenty-six hours was reported as three hundred miles. Latitude 49° 27′, longitude 8° 45′.

When we came up from lunch we found that a light breeze had set in upon our larboard quarter, and our jib and forward trysails were spread to take advantage of it. The wind freshened as the afternoon grew on, and at three o'clock the billows began to crispen at their tops and indicate a rising sea. At four o'clock a drizzling rain set in, and the still strengthening wind gave promise of a stormy night. Some of us had been apprehensive, from the mild manner in which we had set out, that the voyage might run through the entire length of its term in the same dull way, and thus, while it deprived us of the least possibility of becoming heroes, land us at New York without any further knowledge of the ship and her sea-going qualities than we could have learned by studying her while anchored in the Thames. The fear of such disappointment, however, was dispelled by the time we had wiped our beards from dinner, for on ascending to the deck at six o'clock and taking our position on the elevated grating in her bow, we saw the leviathan, before so dead, so apparently inert, and which had been passing through the waters like some spectral island, quicken with life and bend with a slow grandeur to the motion of the sea. 'Thank God, she rolls!' exclaimed an experienced officer on her first trial trip, when she was caught in a series of heavy billows off Portland Race, and it was with something like the same ebullition of delight that we saw the mighty ship cast her silent disposition off and make her obeisance to the still mightier deep. Her motion was a gentle and majestic swing from side to side, the extent of three or four degrees, and now and then when a billow fell away from her bow and a swell at the same time would roll underneath her stern, she would mildly yield her head,—not short and sudden, with a plebeian start, but with a monarch's measured grace, as if she felt herself to be the master, and only yielding to the courteous laws of life. It was a great treat to see her thus leaning her way from side to side through the parting waters, while good-sized ships, which were then in sight, were rolling uneasily or pitching from stem to stern. It was like some accomplished swimmer, who sweeps forward gracefully hand over hand, compared to a clumsy novice who barely manages to keep himself afloat through the rapidity of a short digging motion. The 'Great Eastern' was alive; but mighty as she was, still she was amenable to that vast throb and pulsation of the sea which is mightier than the mightiest. Nevertheless she proved, by the comparison before us, her superiority to all ordinary ships, as well as to any disturbing motion. In fact, her soft undulations gave actual relief and pleasure to every one who stood upon her deck. And all the while this motion was upon her the skittles were played at one of the after-holds. Nevertheless, let it be noted here that the theory that ships above a certain size will march through the wave superior to the perturbation of the sea is ended by our experiment forever. No ship can be made large enough to entirely ignore the gigantic pulsation of the ocean. The foresail and fore-topsail were drawing well at dark, and the wind, which now struck us almost astern, was whistling through our cordage with great noise.

"A GALE.—Tuesday, January 19, I was awakened a little after midnight by the howling of the wind, the shouts of the men taking in sail, and a great tramping overhead. The vessel was rolling more than she had at any time before,—say about eight or nine degrees,—and I could now feel a little vibration of her bow, imparted by the screw as it smote and scudded into the water whenever the motion of the vessel lifted its blades above the surface. I went to my window, but the night was too thick for anything but darkness to be seen, and all I could distinctly hear was the measured wail of one hundred and twenty men (for both watches had been called up) in chorus, to 'haul the bowline, haul,' while engaged in trying to take in the mainsail and main-topsail. The wind seemed to soften a little at two o'clock, but perhaps that was the notion of my drowsiness, for I fell asleep at that hour, while the men were still as busily engaged at the mainsail as ever. I afterwards learned that it had employed them five hours to furl it in the furious tempest that prevailed. The cause of this difficulty was partly owing to the violence of the gale acting upon the immense area of the sail, and partly to the unhandy size of the tackle by which it

must necessarily be worked. Everything is exaggerated in the way of size on board the 'Great Eastern,' and to be handled aloft as other ships she requires an extra breed of men. The gale subsided a little in its fury at four o'clock, but when I arose, at seven, I still found it blowing very hard, and the sea covered with a thread-like foam, which filled the hollows as well as whitened on the billow tops. Still the ship rolled only eight degrees, and her stately nod did not disturb a plate upon the table. The storm-rack was laid at breakfast to protect the dishes, but it was not needed, for my full tea-cup sat outside of it without being in the slightest peril of a slip. Nevertheless, a three-thousand-ton vessel would have been pitching sadly. The motion did not succeed in making a single person sea-sick, though there were among her passengers several who had never been to sea before.

"The wind moderated still more during the afternoon, and we set all our top-sails, but the ship kept up her motion, and went frolicking along her path as full of life as a clipper-brig or a pilot-boat. Nothing could be more beautiful than to stand upon the elevated grating in her bow and see her stern lift itself majestically against the sky as we dropped into some yielding wave before us, or to behold her rising sideways to her equilibrium, like some frolicking beauty lifting her shoulder in her downy bed. I could hardly realize, as I viewed her buoyant step upon the deep, that ten thousand plates of iron, representing twelve thousand tons of inert metal, clamped by three million rivets, and bearing within, besides her ponderous engines, six thousand tons of coal, could career thus, cork-like, upon the bosom of the thin and shifting element below. Yet there she rode, ship-like and sweet, 'a thing of beauty and of joy forever.' The most striking idea of her size, however, and the greatest demand upon your wonder that she swims so lightly, is obtained by going down by her sponsons, outside and aft the paddle-boxes, which enables you to see the entire of her towering section abaft the wheel. From that point you face up and down her massive sides and see the black warehouse, for it looks not like a ship, grandly rise and fall in the hissing and downy foam which the wheels send flying by her run. This flying foam unites beneath her stern, and is there strewn into lace-work by the propeller, and goes seething on its broad path for miles. I think the scene from this lower platform of the gangway gives the finest idea, while in motion, of the vast power and grandeur of the ship. The deck and rigging, on the other hand, being seen all together, lose in a little while their command upon the wonder, for their great symmetry so wins upon the eye that they mingle together in apparently usual degrees. It is only when in comparison with some other object that the 'Great Eastern' sensibly exhibits her huge proportions to an accustomed eye, and then everything else is dwarfed by her neighborhood.

"Wednesday, June 27.—Fine weather, with a breeze which kept four of our try-sails set, continued the afternoon, but at six o'clock a very heavy fog set in, which condensed itself upon the rigging in huge drops that fell upon the deck like rain. So dense did this all-pervading mist become that the lookouts could scarcely see ten feet from the ship, and our lights could not have been distinguished at the distance of a hundred yards ahead; so out of mercy to the unwary who might possibly be in our path, at near reach to shore, we slackened our speed down from fifteen to seven and a half knots, and ran at this rate, with frequent warnings from our whistle, all night. Under this state of affairs it was thought prudent, moreover, that we should make soundings to ascertain with certainty exactly where we were, but the effort failed at every attempt, in consequence of the great height we were above the water, requiring more line than we could pay out while the vessel was in motion. We slowed her down to six knots, then to four, and then to two, but still it would not answer, and the order went from the captain that the ship must be absolutely stopped.

"It had been the particular pride of Mr. McLenan, the chief engineer, who is a perfect enthusiast in his duty, that the ship's engines, which had been so much abused and misrepresented for the last year, should perform what scarcely, if ever, had been done before: and that was to make a first Atlantic voyage without a single

moment's pause from port to port. When, therefore, he heard the order to stop the ship he received it like a man who was smitten with a sentence, and asked with the greatest earnestness if we could not get along without. The answer was against him, and the lungs of the monster were folded from their respirations, and after ten minutes' run with silent wheels and blades, and final reversal of her wheels, she sat still upon the waters. This event took place at 11.40, but a cast of one hundred and fifteen fathoms of line gave us no bottom, and we went on again, at twelve o'clock, still, however, continuing only at half speed. At ten minutes to five this morning we made another pause to heave the lead again, and this time with a cast of sixty-five fathoms we found bottom on George's Bank, and at ten minutes past five went on again. The fog having lifted, we now resumed our speed and proceeded at our usual rate of thirteen and fourteen knots. During these two pauses the engineer rapidly examined such of the screws and nuts as were not accessible during the action of the engines, but did not discover one that was out of place or that required tightening,—a great proof of the excellence and condition of her machinery.

"Thus ended the first transatlantic voyage of the 'Great Eastern,' and though it may be regarded as a failure in the way of speed, it will be perceived there were interests at stake which transcended that consideration, and which doubtless justified the commander in the unusual care he took to keep the great ship safe.

"Captain Vine Hall is one of the most experienced navigators of the English East India trade, but in addition to the caution which he naturally felt incumbent on him from the fact that he had never crossed the Atlantic before, he was doubtless deeply impressed with the paramount importance, not only to his employers and the cause of science, but to England and the whole world, of giving a substantial proof that ships of the size of the 'Great Eastern' could safely cross the deep. It was therefore properly a matter of secondary consequence to him whether the enthusiasm of his passengers or the ardor of his engineers or officers should chafe at his divergences or extra care; he accomplished the great point that was required, and we who left England with him but ten days before are here to approve his action. When he returns to England in September he will give the leviathan its head, and she will then prove for herself that speed is one of her attributes as well as safety. In fact, she has proven it already by the manner in which she has accomplished this voyage, and there is not a passenger who crossed in her but views her as beyond all comparison the most superior passenger-ship that ever floated. The extra distance which she ran on this trip is certainly equal to more than a day's travel, and when we add to this that twenty-four hours' margin is always allowed to a new ship's first voyage, and take into consideration also that not an officer on board ever made a voyage in her, that the men were all raw recruits, fresh levied within three days of starting, and that even the stokers did not know how to spread coal to advantage on the fires, we cannot help regarding even the *time* she made as a great triumph. As to her comfort and convenience as a passenger-ship, it is hardly possible to say too much in praise of her. She meets all the requirements of the most luxurious hotel, and when the weather drives her inhabitants below they can promenade through her cabins upon long walks, or lounge about upon superb divans, listening to music that would not discredit the most pretentious concert. By her continued steadiness sea-sickness is entirely ignored, and in the way of strength, no iron structure that ever has been made can at all compare with her.

"This was impressed upon us by every sway of the sea, and the idea which she continually enforces on the mind, above all others, is her absolute safety from all ordinary dangers of the ocean. Against the risks resulting from contact with a solid body she is beyond all calculation stronger than anything which has been seen afloat. The manner in which her vast weight stood poised upon two single rests in the builder's yard for weeks before her launch, and the thundering against her sides of the huge battering-rams that smote her inch by inch towards the water, give evidence of what she can endure. No shoal or beach could break her before all her

passengers could escape, for 'her scales are her pride, shut up together as with a close seal. They are joined one to another, they stick together that they cannot be sundered.'

"Above all other ships she should be chosen by the timid, and it really is a puzzle to me how so many intelligent men who had read the history of her construction, and who were about crossing to New York at the date of her departure, could be induced to choose any other vessel. She is certainly exempt from all the ordinary dangers of the sea, and any one who will go into her bow and look at the fourteen feet of matted iron in that welded beak, will credit her with sufficient power and impulse to split and push aside any ordinary iceberg."

ARRIVAL AT NEW YORK.—The "Great Eastern" arrived at the bar at about seven o'clock on Thursday morning, and it being known that she would be detained outside until high water (two o'clock), ample time was afforded to everybody who had the means to go down the bay to meet her, or to take eligible positions to witness her approach to the city. Messrs. Grinnell, Minturn & Co., the consignees of the ship, with their friends and the press, went down in a steamer and came up on board the "Great Eastern." Of the passage of the bar, and the trip up the bay, the New York *Times* gives the following sketch:

"About two o'clock the order was given to cast off the steamer's tugs, which lay like two long-boats under her quarters, and Mr. Murphy, the pilot, with Captain Hall, mounted the starboard wheel-house, and the word was passed, 'Head slow with the paddles.' In another moment the enormous wheels were in motion, and the ship began to move. Slowly her great prow was turned off shore and headed towards the light-ship, for the purpose of getting a good entrance to the ship-channel. At 2.30 P.M. both the paddles and screw were in rapid motion, the ship heading towards Sandy Hook. The speed of the ship was now increased, so that the half-dozen steamboats which followed in her wake could with difficulty keep up with her. At three o'clock the ship was on the bar, when the paddles were slowed, as is the custom in passing that point with all vessels of heavy draught. She went over, however, without any difficulty, and the long-dreaded bar was safely passed. Full steam was now given to both the screw- and paddle-engines, and she made excellent time in coming up with and passing the Hook. Here the telegraph station was decked out with a profusion of flags, and as 'they had no guns to fire,' the fog-bell was vigorously tolled, a greeting to the passing steamer. This was replied to by cheers from the passengers gathered on the port side, in which Captain Hall joined; the ensign was also dipped. Meantime an *extempore* lunch was prepared below for the newly-arrived guests, whom Captain Carnagee welcomed to the ship in a few words, to which Mr. Grinnell responded, giving as a sentiment the Press of New York, which was acknowledged briefly by Mr. Raymond and Mr. Erastus Brooks.

"Steering well to the southward to give ample room in which to turn the only remaining point of difficulty,—the Southwest Spit,—the

order was given to slow the paddles to half-speed; the helm was put hard a-port, and in less time than it takes to describe the operation she made the circuit of the spit with all the ease of a pilot-boat. No description could do justice to the scene of animation and enthusiasm which now surrounded the steamer as she approached the Narrows. Steamers of all sizes and descriptions swarmed about her, crowded with ladies and gentlemen cheering and waving their salutations.

"At a few minutes after 3 P.M. the 'Great Eastern' was dimly discerned in the foggy distance of the lower bay. Then she disappeared behind the bluff, and an hour passed before, over the walls of the new fort, at the distance of four miles, the tall masts of the great ship were seen rapidly passing. With an uncontrollable impulse a shout arose from the vast crowd on the old quarantine grounds and from Burr's Gardens. Opposite Fort Hamilton she stopped, and the fort gave her a rousing salute of cannon. When she resumed her 'onward march, her triumph o'er the deep,'—which at this point meant the bay of New York, that it was said she never could enter,—she in due courtesy replied in cannon. As she passed the various landings on the island she was also greeted with gunpowder, and her health and the good wishes of the spectators were drank, not in as much lager beer as would float her, but certainly in a great quantity of lager beer. As she passed the shore of the island she was admirable in her appearance. Though at the distance of more than a mile and a half, with the smoke of her cannon mantling about her and partially obscuring her magnificent proportions, she announced herself as the leviathan of the bay. By the rule of parallax, her size was indeed enormous, for she seemed to shut from observation miles of Long Island Heights over and below Greenwood and Gowanus. Her appearance as she passed up the bay took everybody by surprise. Not only was no voice of detraction heard, but all spectators were almost madly enthusiastic in her praise.

"The effort to round her to at the foot of Hammond Street was not successful, it being found necessary to moderate her speed so much that steerage-way was lost as soon as the engines were stopped. She accordingly swung with her head up-stream, and the efforts of two tugs, with hawsers at her bow, could not wind her. After drifting with the flood-tide, backing and going ahead for a long time, she was at length turned round, and at about eight o'clock P.M. she was snugly got into her berth and made fast.

"There was no lack of admiration for the vast proportions, the graceful lines, and the internal arrangements and ornamentation of the ship. There was much surprise expressed at the neglected condition of the decks, which appeared as if they had neither been cleaned, scraped, holystoned, or varnished since she was launched. The planks in many places appeared badly shrunken, and suffering for want of wetting down.

The same was observed of the platforms on both sides of the paddle-boxes, and other portions of wood-work of the ship. The smoke-pipes look as if they had encountered the storms of a voyage from India instead of England, and there is a general dirty appearance of the whole outside portion of the ship. It is understood that it will take several days to put her in condition to receive the visits of the public."[60]

1858.—In 1858, it being questioned how far the Yang-tse-Kiang was navigable, Captain Sherard Osborne, R.N., in the "Furious," accompanied by the "Cruiser," steamed up the river to Hankow, and was the first to navigate a foreign ship to that port,—a service which Lord Elgin availed himself of to insist that Hankow should be opened to foreign commerce.

1859.—In 1859 steam navigation was introduced upon the Amoor River, China, by private means. The first steam vessel, called the "Admiral Kozawitch," was launched upon the waters of that river in the summer of that year. She was built in the United States, brought over in pieces, and put together at Nicolajefsk. She was constructed of timber, and had one paddle-wheel, and that astern. On her first trip she went up the river to the confluence of the Shika, and returned to Nicolajefsk. She then went up the river as far as the thriving town

[60] The Hon. John McLeod Murphy, once an officer of the United States navy, in a lecture on "American Ships and Ship-Builders," delivered at Clinton Hall, New York, December 29, 1859, took occasion to say,—

"I am not a prophet, nor the son of a prophet, but I hazard little in expressing the conviction that a monster ship, far exceeding the 'Great Eastern' in model and build, will yet be launched in this country; but her keel will not be laid until it is clearly demonstrated that she can be *made to pay*. Perhaps in the calm waters of the Pacific, when our trade shall have been fairly opened with Japan, the vessel that shall bring her enchanting fabrics and people will outstrip in magnitude and strength and speed the gigantic form of that which was conceived in the feverish brain of Brunel."

The Manchester (England) *Examiner* reported in 1880 that the "Great Eastern" would be sold by auction soon, unless previously disposed of by private treaty. The step proposed was foreshadowed in the last report of the directors of the company, as will be gathered from the following paragraph: "During the past year several proposals for the employment of the ship have been made, but have fallen through from some cause or other; the directors are, however, using their best exertions to attain that object, which now becomes imperative, as the funds available for the maintenance of the ship are approaching exhaustion, and under these circumstances the directors feel it desirable to take powers from the shareholders to dispose of the ship in case no favorable proposal for chartering her should be received." The balance to the debt of profit and loss account at the close of the last year was eight thousand four hundred and thirty-one pounds. Considerable expenditure was made on the vessel last year, when she had new upper decks and part new masts. It may be stated that the capital of the company is one hundred thousand pounds, and that she stood in the books at the close of 1880 at eighty-six thousand seven hundred and fifteen pounds. She has been employed in various ways, but, perhaps, in none more successfully than the laying of the Atlantic cable. She is stated now to be in excellent condition.

of Michael Semenofshy, at the mouth of the Soongari, and finally to Nianchoorsky, near Algoon, where she remained for the winter.

The principal ocean steam lines of the world in 1858 were as given below. There were other steam lines in Europe, but I have been unable to obtain any definite information concerning them, owing to their continual change and the ships passing into new hands. The table evidences the first increase of ocean steam navigation in the eighteen years after its inauguration.

OCEAN STEAM LINES OF THE WORLD—1858.

LINE.	SERVICE.	SHIPS.	TONNAGE.
Cunard, Paddle-wheel	Liverpool, New York, Boston, and Halifax	8	12,000
" Screw	" " " " "	4	4,800
North Atlantic Steamship Company	St. John's and Portland	3	4,800
European and American Steamship Co.	Bremen, Antwerp, Southampton, & New York	4	10,000
" " " "	" " " to Brazil	4	9,000
London and Canada	London and Montreal	2	1,870
Liverpool and Canadian	Liverpool and Quebec	4	5,000
Liverpool, Philadelphia, and New York.	" " New York	4	8,700
Glasgow and New York	Glasgow and New York	3	6,200
Belgian Transatlantic	Antwerp and New York	4	8,800
" "	" " Brazil	5	6,500
Hamburg and American	Hamburg and New York	4	7,300
" " Brazilian [1]	Hamburg and Rio de Janeiro	2	4,500
Genoa and Brazilian	Genoa " "	4	8,000
Royal Mail Company	Southampton, West Indies, Central America, South America	18	21,510
" " "	Southampton, Pernambuco, Rio, Bahia, and La Plata	4	6,820
Pacific Steam Navigation Company	Panama to Valparaiso and intermediate	7	5,719
Peninsular and Oriental Company	Portugal, Spain, Malta, Alexandria, East Indies, China, and Australia	39	49,416
European and Australian Royal Mail Co.	Southampton, Alexandria, Suez, and Sydney.	7	15,500
Australian Royal Mail Company	Transport and other	4	7,800
Rotterdam and Mediterranean	Rotterdam, Leghorn, and Trieste	4	1,900
North of Europe Steam Navigation Co.	African	4	3,200
McIver's	Liverpool and Mediterranean	10	9,000
"	" " Havre	2	2,000
Bibby's	Liverpool and Mediterranean	11	11,700
Fowler's	" " "	6	7,500
Dixon's	" " "	4	3,800
Liverpool and Australian	" " Australia	2	7,000
London " "	London and "	4	7,500
African	" Liverpool, and Africa	5	5,000
Union Screw Company	Southampton and Cape of Good Hope	3	1,800
Luzo-Brazileira	Lisbon and Brazil	4	8,000
Austrian Lloyds	Very large Mediterranean service	...	Unknown.
Messageries Impériales	Mediterranean, Black Sea, Levant	50	" [2]
W. Hartlepool Steam Navigation Co.	Hartlepool, Hamburg, and St. Petersburg	6	"
Danube Steam Navigation Company	Vienna, Galatz, and Constantinople	6	"
Hamburg and Spanish	Hamburg, Southampton, and all Spanish ports.	2	2,000
East India Company	Suez and India, and the Bombay Mail Lines	12	11,471
Spanish and Cuban	Cadiz, Havana, and Mexico	5	9,000
Companhia Brazileira	Rio de Janeiro to the Amazon and La Plata	7	5,500
Collins Company	New York and Liverpool	3	9,727
Havre Steam Navigation Company	" Southampton, and Havre	2	4,548
Cornelius Vanderbilt	" " " Bremen	3	6,523
United States Mail Steamship Company.	New York, Havana, Aspinwall, & New Orleans.	6	8,544
Pacific Mail Steamship Company	Panama, California, and Oregon	13	16,421
New York and New Orleans	New York, Havana, and New Orleans	2	3,198
New York and Alabama	" " " Mobile	1	1,300
Charleston and Havana	Charleston, Key West, and Havana	1	1,115
Savannah Steamship Company	New York and Savannah	4	4,793
New York and Charleston Steamship Co.	" " Charleston	4	4,680
" " Virginia	" Norfolk, and Richmond	2	2,371
Philadelphia and Savannah	Philadelphia and Savannah	2	2,600
Boston and Baltimore	Boston and Baltimore	2	1,600
Texas Steamship Company	New Orleans and Galveston	4	2,400
Southern Steamship Company	" " Key West	2	1,000
Mexican Steamship Company	" Tampico, and Vera Cruz	1	960

[1] Building another steamer of 2500 tons for the Brazil line.

[2] These vessels average about 250 horse-power each. Their tonnage is large, probably 1200 tons each.

In February, 1860, the Yang-tse-Kiang was opened by treaty to ships of other nations, and the "Scotland," a British, iron, auxiliary screw steamship of eleven hundred tons gross register, Captain A. D. Dundas, R.N., was the first foreign merchant-vessel to load a cargo from Shanghai to Hankow bringing back tea for transhipment to Europe and America.

The first steamer owned by the Japanese was the "Emperor," a yacht presented them by Lord Elgin on making his commercial treaty in 1858–59. Since then the Chinese have become owners of steamers with astonishing rapidity.

In 1861 the Prince of Satsuma purchased the "England" and "Scotland," two British screw steamships of eleven hundred tons gross register, being the first foreign vessels purchased by the Japanese, except by the government. To show the skill and ingenuity of the Japanese, they made boilers of copper for the "England" within twelve months of the time when she came into their possession. The "England" was seized and scuttled in August, 1863, by the English at the bombardment of Kagosima, and sunk in deep water. The "Scotland" was in the service of the Japanese in 1870.

"THE MONITOR"—1861.—A resolution of the United States Senate, July 24, 1868, requested the Secretary of the Navy to communicate to that body the facts concerning the construction of the ironclad "Monitor." In answer, Secretary Welles made an elaborate report (Exec. Doc. No. 86, Fortieth Congress, second session) detailing the history of her construction, together with that of two other ironclads,—the "New Ironsides" and "Galena,"—constructed differently, as recommended by a board of navy officers September 16, 1861, composed of Commodores Joseph Smith and Hiram Paulding and Commander Charles Henry Davis.

The Secretary visited Connecticut in September, and while at Hartford, C. S. Bushnell, Esq., brought him the plan of the original "Monitor," invented by Captain John Ericsson, of New York. It received the instant approval of the Secretary, who requested Mr. Bushnell to proceed to Washington without delay and submit it to the board. He was assured that in case of unavoidable delay beyond the time limited for receiving proposals, an exception should be made in favor of this novel invention of a submerged vessel with a revolving turret, and that it should be embraced among the plans on which the opinion of the board would be required.

The board of officers in their report say, with regard to Mr. Ericsson's proposition,—

"This plan of a floating battery is novel, but seems based on a plan which will render the battery shot and shell proof. We are apprehensive that her properties for sea are not such as a seagoing vessel should possess. But she may be moved from one place to another on the coast

in smooth water. We recommend an experiment be made with one battery of this description on the terms proposed, with a guarantee and forfeiture in case of failure in any of the properties and points of the vessel as proposed. Price, $275,000; length of vessel, 172 feet; breadth of beam, 41 feet; depth of hold, 11½ feet; time, 100 days; draught of water, 10 feet; displacement, 1255 tons; speed per hour, 9 statute miles."

In accord with this recommendation, the 4th of October, 1861, John Ericsson, John F. Winslow, John A. Griswold, and C. S. Bushnell contracted with Gideon Welles, the Secretary of the Navy, on behalf of the United States, to build the original "Monitor," as she was later named by her inventor, and to have her and her equipments in all respects ready for sea in one hundred days after the date of the contract. The agreement was "to construct an ironclad, shot-proof steam battery of iron and wood combined on Ericsson's plan; the lower vessel to be wholly of iron, and the upper vessel of wood; the length, one hundred and seventy-nine feet; breadth, forty-one feet; depth, five feet, or larger if the contractors thought it requisite to carry the armament and stores required." Masts, spars, sails, and rigging were to be furnished sufficient to drive the vessel six knots an hour with fair breeze of wind; steam-power was to be supplied to give her a speed of eight knots, and she was to carry provisions, water, and stores of all kinds for one hundred persons for ninety days, and fuel for her engine for eight days; the deck, when loaded, was to be eighteen inches above the load-line amidships. It was also expressly stipulated that no member of Congress or officer of the navy, or any person holding office under government, should share in the contract or in any benefits arising from it,—a wise provision.

The payments made to the contractors, as per agreement, the last being only five days before the "Monitor" sailed from New York, were as follows:

1861, November 15, first payment, $50,000, less 25 per cent. . . .	$37,500
" December 3, second payment, $50,000, less 25 per cent. . . .	37,500
" December 17, third payment, $50,000, less 25 per cent. . . .	37,500
1862, January 3, fourth payment, $50,000, less 25 per cent. . . .	37,500
" February 6, fifth payment, $50,000, less 25 per cent. . . .	37,500
" March 3, sixth payment, $25,000, less 25 per cent.	18,750
" March 14, last payment, reservations	68,750
Total	$275,000

By the terms of the contract the reservations were to be retained until the points and properties of the vessel were fully tested, not exceeding ninety days. Her performance from New York to Hampton Roads and her encounter with the "Merrimac" were deemed satisfactory tests, and the payment of the reservations was made within one

week after the action in which she was engaged, as will be seen by the date of the last payment. Erroneous newspaper statements were made that the "Monitor" "was built by the contractors at their own risk, and that the government was not to be called upon for remuneration until the vessel had been tested in action. Strong in faith, receiving but a negative support from the Navy Department, the contractors completed the 'Monitor' at their own cost." It was also stated that a member of the House of Representatives from New York "advanced the money and paid the expense of getting the 'Monitor' which met the 'Merrimac' at Hampton Roads, built." The truth is the money applied to build the "Monitor" was appropriated by Congress in August, and the money promptly handed over to the contractors, agreeably to their contract, as the work progressed. While building, the novel experiment received ridicule and abuse, but after her wonderful achievement in Hampton Roads the tone was changed, and persistent efforts were made to deny the Navy Department any credit for her adoption and construction.

The "Monitor" left New York March 6, 1862, under command of Lieutenant John L. Worden, and on the 8th reached Hampton Roads, and the next day her memorable encounter with the "Merrimac" took place.

The hull of the "Monitor" was built by Mr. T. F. Rowland, at Greenpoint, from Captain Ericsson's drawings,[61] and under his personal supervision, the material (plates, bars, rivets, etc.) being furnished by his associates, Messrs. Griswold, Winslow, and Bushnell. The turret was built at the Novelty Iron Works, agreeably to his plans and under his supervision, with plates, rivets, etc., furnished by his associates. Being too heavy for transportation, it was taken down and placed in sections on the deck of the vessel. The port-stoppers, of heavy hammered wrought iron, were made at the steam-forge of Mr. C. D. DeLancey, in Buffalo. After the guns were discharged and run back into the turret, the stoppers were swung over the port-holes, to prevent any shot from entering the ports. The closing being regulated by machinery, was instantaneous, and that side of the turret swung away from the enemy, the guns loaded and swung back again, and guns discharged. Thus the ports were constantly protected, either by the guns obstructing, or by the ports being closed by the stoppers.

The entire internal mechanism of the turret was built to Captain Ericsson's working plans at the Delamater Iron Works. The hull and side armor was put up by Mr. Rowland. The mode of launching was planned by him. To prevent the vessel, when fully equipped with machinery, turret, and armor, from plunging under water, Mr. Rowland

[61] A Brief Sketch of the First "Monitor" and its Inventor, a paper read before the Buffalo Historical Society, January 8, 1874, by Eben P. Dorr. 8vo. Pp. 49.

constructed large wooden tanks, securing them under the stern. The result of these joint efforts was that within one hundred days from laying the keel-plates of the hull the whole work was completed and the engines of the vessel put in motion under steam.

The "Monitor" was launched on the 30th day of January, 1862, and her first trial trip and delivery to the navy-yard was February 19, 1862. She had two trial trips afterwards. On her second trial she could not be steered, and went no farther than the foot of Wall Street, New York. On the third trial trip, about March 4, she went down to Sandy Hook and tried her guns, having a board of officers consisting of Commodore Gregory, Chief Engineer Garvin, and Constructor Hart, who reported favorably of her performance.[62]

How the name "Monitor" was given to this first turreted ironclad —a name that has since become generic for all this class of vessels —is told in the following letter from its inventor ten days before her launch:

"NEW YORK, January 20, 1862.

"SIR,—In accordance with your request I now submit for your approbation a name for the floating battery at Greenpoint.

"The impregnable and aggressive character of this structure will admonish the leaders of the Southern Rebellion that the batteries on the banks of their rivers will no longer present barriers to the entrance of the Union forces.

"The ironclad intruder will thus prove a severe monitor to those leaders. But there are other leaders who will be startled and admonished by the booming of the guns from the impregnable iron turret. 'Downing Street' will hardly view with indifference this last 'Yankee notion,' this monitor. To the Lords of the Admiralty the new craft will be a *monitor*, suggesting doubts as to the propriety of completing those four steel-clad ships at three and a half millions apiece.

"On these and many similar grounds I propose to name the new battery 'MONITOR.'

Your obedient servant,

"J. ERICSSON.

"To GUSTAVUS V. FOX,

"Assistant Secretary of the Navy."

When the "Monitor" was nearly ready for commission, Lieutenant Worden was authorized to select a crew for her from the receiving-ship "North Carolina," or any other vessel-of-war in New York Harbor. Under that authority he asked for volunteers from the "North Carolina" and frigate "Sabine," and after fully stating to the crews of those vessels the probable dangers of the passage to Hampton Roads, and the certainty of important services to be performed there, he had many

[62] Previous to 1854, Ericsson's mind had dwelt upon the idea of planning and constructing an iron-plated shot-proof ship-of-war, and on the 26th of September, 1854, he forwarded from New York to Napoleon III. a plan of such a ship, with a synopsis of his plans, which shows beyond all cavil that America is the birthplace of the "Monitor," and that John Ericsson, the Swede, is its sole inventor. Ericsson's letter was promptly acknowledged by the emperor, but he did not embrace the opportunity offered, and the first monitor was built for the United States in the early period of its civil troubles.

more volunteers than was required. It is unnecessary, and would be out of place here, to detail the fight in Hampton Roads,—the first naval duel between ironclads; that belongs more properly to the naval history of the period. Suffice it to say, the little turreted vessel, mounting but two guns, stood up successfully to the defense of twenty-one ships-of-war, mounting two hundred and ninety-six guns, all alike defenseless against the attack of the ironclad "Merrimac." She was a modern David, taking the forefront of the battle against a modern giant Goliath, while the hosts stood by anxious spectators of the conflict.

From the 10th of March until the destruction of the "Merrimac," on the 11th of May, the "Monitor" remained at Hampton Roads, guarding the Elizabeth and James Rivers, always ready for the "Merrimac." During this time her pilot-house was strengthened by heavy pieces of oak and three one-inch layers of iron plates. May 8 she engaged the battery on Sewell's Point in company with the fleet. May 12 she led the vessels that went to Norfolk when that city was evacuated by the rebels. On the 15th she participated in the engagements of Fort Darling, seven miles below Richmond. From that time until the retreat of the army from the Peninsula she was employed patrolling the James River, and arrived at Newport News August 31, being the last vessel that came down the James River. In September the "Monitor" proceeded to the Washington Navy-Yard for repairs, and sailed again for Hampton Roads in November.

On the 29th of December, 1862, under the command of Commander John P. Bankhead, she sailed for Beaufort, North Carolina, in company with the United States Steamer "Rhode Island," her convoy, and on the night of the 30th she foundered near Cape Hatteras. About half of her officers and crew were carried down with her, the others escaped to the "Rhode Island." The cause of her foundering is not known. "It may, perhaps," says Mr. Dorr, "be assigned to the fact that she had lain all summer in the hot sun of the James River. The oak timber which had been fitted to the top edge of the iron hull had shrunk so that when in the heavy sea there was two or three feet of water over it most of the time on the weather side, and the water found its way through this space and flowed in great volume into the ship with fatal effect." There can be, I think, no doubt the battering the great overhang of her deck received from the enemy caused it to separate from the hull to which it was fastened, and allowed the water to flow in which sunk her. The report of the board of officers who recommended her construction, says they were "somewhat apprehensive that her properties for sea are not such as a seagoing vessel should possess," and this opinion is fully borne out by this result.

THE "FAID RABANI."—A beautiful steamer, named "Faid Rabani," or "Divine Favor," was built as a river pleasure-yacht for

the Pacha of Egypt by an English firm in 1863. She was an exquisitely-modeled vessel of the following dimensions, viz.: keel and fore-rake, one hundred and eighty feet; breadth of beam, twenty feet; depth of hold, nine feet; draught of water, three feet; power of engines, one hundred and fifty horses. The yacht was furnished with oscillating engines, had feathering paddles, and performed thirteen knots an hour without the slightest perceptible vibration. Her engines were bright with brass- and steel-work, and finished with the same taste and care used in turning out a gold watch. Although the vessel had an ordinary escape-pipe, it was not used, for the steam was blown into the water from the sides of the yacht. She had three safety-valves, and a beautiful small brass donkey-engine, independent of the others, for supplying the boilers with water when the large engines were still. The principal features of the "Faid Rabani," however, were her splendid interior furnishings and decorations, including no less than four hundred and fifty pictures of separate subjects, set in frames. His Highness's reception-room, which was in the poop, was an apartment of unrivaled beauty, fitted up with the richest rosewood bulkheads, door, etc., the panels of which were filled with beautiful pictorial designs on *papier-maché*. The divans extending round the saloon were covered with costly cloth of gold, from the front of which was suspended gold-embroidered needle-work and massive gold-bullion fringe. Between the windows were pictures of fruit and flowers, birds, etc., and vases enriched by precious stones, executed by a new patent gem-enamelling process. The ceiling between the beams—which were of mahogany, French polished—was filled with designs of fruit and flowers on *papier-maché* panels, enriched with gold-border mouldings. His Highness's bedroom was fitted up in a corresponding style of elegance. The cabins were decked out in a style of great costliness and magnificence; the fore-cabin contained twelve apartments for the pacha's officers and suite. A beautiful awning covered the main deck and poop. In point of decoration the outside of the yacht was worthy of the interior. Round all the windows, from stem to stern, were carved and gilt architraves, and the bulwarks were ornamented with carved fretwork, relieved with gold. The paddle-boxes were also highly ornamented, and on a shield in the centre was the vessel's name in Arabic. The figure-head was composed of his Highness's crest, supported by two lions, richly gilded. The hull was painted a very rich green color, and was literally one blaze of gold from stem to stern.

In 1867 the Memphremagog Steam Navigation Company had three steamers plying upon the lake of that name in New Hampshire, and two more upon the stocks.

A traveler that year thus describes a trip in one of these boats to inspect another upon the stocks:

"Friday last I took a trip upon the 'Mountain Maid' to Magoy to

inspect the new boat. She is no cheap affair, and will far exceed the best of the Winnepesaukee boats in the completeness of her construction, in speed, and in her appointments, and will equal the largest of them in size. I am sorry she is not an American boat, although American capital has been liberally invested in her. She will fly the flag of the New Dominion of Canada (supposing that to be different from the British bunting).

"The name of the new steamer is taken from Mount Oxford, the highest mountain in Canada, which stands sentinel at the outlet of the lake, rearing its pyramid of five thousand feet almost from its waters. (The summit is only six miles from the lake shore.) The hull of this steamer is iron, the plates having been made and fitted together upon the Clyde. Her length is one hundred and seventy feet; her engine (built in Montreal) has a thirty-six-inch cylinder, ten feet stroke, is low pressure, and of superior finish.

"The company to which this boat belongs has also purchased the 'Mountain Maid' and completely rebuilt her. As the 'Oxford' is calculated to make two trips a day through the lake, the 'Maid' will run as an auxiliary freight- and tow-boat."

1869.—The "Kate Corser," the first steamer which ever crossed the American "Dead Sea,"—Great Salt Lake,—and which was employed for some time in transporting ties to the Union Pacific Railroad, in 1869 made a successful trip up Bear River to Corinne. The local newspaper says, "On nearing the city the circus band-wagon containing the members of the band, with several other carriages, started down to meet her. About one mile below she steamed to shore and took them aboard. She stemmed the current admirably, and bore up to the city like a swan, amid the sound of swelling music, the deafening boom of anvils, and the cheers of the throng upon the river's bank." Bear River was found to be perfectly free from falls or rapids; the current, however, was very strong.

Extraordinary Inland Voyage.—On the 5th day of August, 1869, the steamer "Helen Brooks" left Baltimore, Maryland, for Bayou Teche, Louisiana. She left Baltimore by way of the Chesapeake Bay, and passed through the State of Delaware by canal; up the Delaware River to Trenton, New Jersey; through the State of New Jersey by canal; down the Raritan River to New York City; up the Hudson River to Troy; through the State of New York by the Erie Canal to Buffalo; thence by way of Lake Erie to Chicago; down through the Illinois Canal to the Illinois River; and thence down the Mississippi River, arriving at Napoleon October 14, 1869, after a circuitous journey of over three thousand miles.

The mercantile steamers of the world, 1870–74, were:

Nationality.	Number.			Average Size, in Tons.			Tonnage.		
	1870.	1873.	1874.	1870.	1873.	1874.	1870.	1873.	1874.
American	597	403	613	861	1199	1254	513,792	483,040	768,724
Asiatic	.....	.....	6	.....	.....	576	.....	.....	3,459
Austrian	74	91	81	599	925	1025	44,312	84,155	83,039
Belgian	14	42	39	746	725	1039	10,462	30,444	40,536
British	2426	3061	3002	681	857	1005	1,651,767	2,624,431	3,015,773
Central American	.....	.....	9	.....	.....	592	.....	.....	5,332
Danish	44	71	67	275	486	582	12,085	34,498	38,976
Dutch	82	95	107	481	766	876	39,405	72,753	93,723
French	288	392	315	739	808	1012	212,976	316,765	318,757
German	127	200	220	827	1024	1222	105,131	204,894	268,828
Greek	8	8	9	408	424	592	3,267	3,390	5,329
Italian	86	103	110	423	826	827	36,358	85,045	91,011
Norwegian	26	88	112	282	473	453	7,321	41,602	51,103
Portuguese	18	17	23	729	855	802	13,126	14,536	18,452
Russian	62	114	144	458	592	771	28,422	67,522	111,072
South American	.....	.....	72	.....	.....	728	.....	.....	52,387
Spanish	148	202	212	492	686	733	72,845	138,675	155,417
Swedish	83	143	195	224	373	397	18,633	53,327	77,440
Turkish and Egyptian	.....	9	29	.....	339	949	.....	3,049	27,530
Various	49	109	.....	481	643	.....	23,550	70,067	.....
Totals	4132	5148	5365	676	841	974	2,793,432	4,328,193	5,226,888

1872.—From 1841 to 1872 the following forty-four steamships, employed on voyages between the United States, England, and the Continent, were lost:

WOODEN STEAMSHIPS.

Humboldt.	Arctic.
Franklin.	Pacific.

IRON STEAMSHIPS.

President.	Hungarian.	Hibernia.
Columbia.	Connaught.	Union, No. 1.
City of Glasgow.	United States.	Lafayette.
City of Philadelphia.	Canadian, No. 2.	Cambria.
City of Boston.	Britannia.	Scotland.
City of New York.	Anglo-Saxon.	Union, No. 2.
Lyonnais.	Colorado.	Glasgow.
Tempest.	North Britain.	Cleopatra.
Austria.	Caledonia.	Zoe.
Canadian, No. 1.	Norwegian.	Mina Thomas.
New York.	Bohemian.	St. George.
Indian.	Nova Scotian.	Atlantic.
Arago.	United Kingdom.	Chicago.
	Germania.	

Of these, the "President," "City of Glasgow," "City of Boston," "Pacific," "Tempest," "United Kingdom," and "Mina Thomas" foundered at sea, never having been heard from. Between 1857 and 1864 nine iron steamers, running from the mouth of the St. Lawrence to Portland, were lost.

In 1872 a discovery by which it was claimed the cost of steam-power was reduced more than sixty per cent., was put into practical operation at the Atlantic Works in Boston by Mr. Joel A. H. Ellis and his associates. By a novel process the great amount of heat that escapes into the air in the waste or exhaust steam from engines is utilized by conducting it through the tubes of a boiler filled with the bisulphide of carbon, "a fluid which boils at 110° Fah., and at the temperature of exhaust steam gives a pressure of sixty-five pounds to the inch in the boiler;" the vapor formed in this boiler is used to drive an engine, instead of steam, and, after being used, is condensed by cooling, pumped into the boiler again, and used continuously without loss.

Carefully-made experiments prove that by this process the fuel required to produce one hundred horse-power with the best engines in use would produce two hundred and fifty horse-power, a gain of one hundred and fifty per cent. in the amount of power obtained by the consumption of fuel.

For the purpose of making a careful test of this process, two new engines of the same size and construction were put up at the Atlantic Works; one was run by steam in the usual manner, while the heat that escaped in the exhaust from this engine was used to heat a boiler and drive the second engine. A careful measurement of the power produced by each of the engines showed that while the first engine, worked by steam in the usual way, produced 6.23 horse-power, the second engine, worked entirely by the waste heat escaping in the exhaust from the first, produced 9.12 horse-power, the two together producing 15.35 horse-power with the fuel required to drive the steam-engine alone.

The amount of coal required to run a steam-engine of one hundred horse-power, of the best class in use, is about four thousand pounds per day, or six hundred tons a year. By this discovery it is claimed the same engine can be run with sixteen hundred pounds of coal per day, or two hundred and forty tons per year, saving three hundred and sixty tons of coal a year for each hundred horse-power produced.

For steam-vessels the advantages of this process are greater than for stationary engines, as a large amount of room at present occupied by coal will be saved, and can be used for freight. The vessel could also carry fuel sufficient to last through a much longer voyage, thus enabling steam to compete with sailing-vessels on long voyages advantageously.

In 1875 a high-speed boat was built at St. Petersburg on an improved plan, whose outer hull was made entirely of Muntz metal, which is much used, being cheaper than copper as a sheathing for wooden vessels. In a trial with one of the fastest boats she proved victorious, and accomplished nineteen miles per hour, the engines making

an average of nearly six hundred revolutions per minute, working with steam at one hundred pounds per square inch. This vessel is described as forty-eight feet long at the load-line, having six and one-half feet beam, and three and one-half feet depth of hold, while her mean draught was one foot nine inches. She had compound engines of superior workmanship in every respect, which drove a screw two feet nine inches in diameter, having three feet four inches in pitch.

1878.—A steamboat built by the Coreans is thus referred to in the *North China Daily News* of March 28, 1878:

"STEAMBOATS IN COREA.—Everything European, just because it is so, is despised, but the Coreans try hard to originate wonderful undertakings. For about eight months they have been working at a steamboat, and some ten thousand *taels* have been used up. There is the shell with three keels, which makes the thing rather flat. The bow is sharp, and there are port-holes for cannon; a smoke-stack, which has been observed at work, but the wheels are wanting. Meanwhile, for fear the Japanese might benefit by the sight, this masterpiece was covered in with a wooden frame. Ten years ago they made an iron vessel, but it unfortunately sank when launched."

At the end of the year 1879 there were registered as belonging to the United Kingdom, including the Channel Islands, 20,538 sailing-vessels, of 4,068,742 tons, and 5027 steam-vessels, of 2,511,733 tons, making in the whole 25,565 vessels, of 6,579,795 tons, being 24,811 tons more than at the end of the year 1878.

The numbers for 1879 compared with those of 1866 show in the fourteen years a decline of 5602 in the number of sailing-vessels, and of 834,910 tons in the tonnage; and in steam-vessels an *increase* of 2196 in the number, and of 1,635,548 tons in the tonnage.

The shipping belonging to the United States on the 30th of June, 1879, was classified as follows: 17,042 sailing-vessels, of 2,422,813 tons; 4569 steam-vessels, of 1,176,172 tons; 2394 barges, of 466,878 tons; and 1206 canal-boats, etc., of 103,721 tons; total, 25,211 vessels of all kinds, and tonnage, 4,169,584 tons.

CHINESE ENTERPRISE.—In 1874 there were fifty British steamers profitably engaged in the local trades in Chinese waters. In that year the natives organized the China Merchants' Steam Navigation Company, with the royal consent and support. During the first year the company had six steamers in operation. The next year four were added, and in 1877 the company's fleet numbered sixteen vessels. A fierce competition was waged with foreign companies, during which rates were cut from fifty to seventy per cent. of the former amount. The result was that the Shanghai Steam Navigation Company (foreign) was killed, and its twenty-six vessels and its wharf property were bought by the native company. The aggressive policy thus begun has been continued, until now the Chinese look to a general navigation of the

high seas, and in August, 1880, one of the original six vessels of the China Merchants'· Company entered the harbor of San Francisco. China enjoys the cheapest labor on the planet; has enormous coal-fields and large iron deposits; and a firm of British builders have decided to transfer their capital to China, with a view to beginning the work of ship-building, for which so abundant materials and advantageous conditions for labor exist. Japan is acting with like vigor, and has already several steam lines in operation. From these unexpected quarters, therefore, our revived shipping interests, if indeed anything is done to revive them, must look for competition.

1880.—A REMARKABLE VOYAGE OF A WRECKED STEAMER.—On July 14, 1880, the Chilian transport "Rimac," an iron screw-steamer of twelve hundred and twenty-seven tons, carrying a regiment of cavalry and a valuable cargo, was captured by the Peruvian corvette "Union" and taken to Callao. After the Peruvian defeat at Chorillos and Miraflores the "Rimac" was burned and sunk. The hulk was raised by the Chilians, and was found although severely damaged it could be rendered serviceable, and that the machinery was only slightly injured. Every particle of wood-work was burned out of her, and she presented more the appearance of an empty, fire-worn stove than of a vessel with which the sea could be navigated. The deck-beams were cracked and twisted as if they had been thin iron wires; some stanchions still stood upright, but more had assumed shapes which would have astonished any ship-builder, and the bulwarks were bulged in and out, and shrivelled as if they had been run through some powerful crimping-machine. Damaged as she was, it was the desire of the Chilian government, whose prize she had become, and of the South American Company, who had become her purchasers, that she should be taken back to Chili, and Captain James Hart was called upon for an opinion as to the possibility of taking her to Chili. He reported favorably, although declaring there was much risk, and the voyage was agreed upon. Only the most absolute and trivial repairs were effected, and after the sides had been boarded up to prevent her filling, this damaged iron tank—for it could scarcely be called a vessel—took its departure from Callao. The machinery worked well. But as the engines were intended to drive a heavy vessel, and they were now employed in propelling a light and unladen hull, they were too powerful for their work. They drove it along at a good speed, it is true, but the vibration caused thereby was severe in the extreme. Very heavy weather was encountered, and as the vessel would dip into the sea so they would strike her abeam, the water would rush into the hold, threatening to swamp her, and keeping the pumps constantly at work. All hands were wet through the entire trip, no cabins having been put up. Several of the damaged deck-beams broke, through the severe straining of the sides, and one day the remains of the bridge tumbled

into the hold, carrying with it the binnacle and the wheel, which had been temporarily fixed up. The compass was useless, it being impossible to place reliance in it owing to the vibration causing the needle to revolve the whole time. Steering was done by guess-work, the direction of the sea, which runs from the southward, and the heavens serving as a substitute. The voyage fortunately was performed in safety, and the wreck was finally moored in Valparaiso. The distance from Callao to Valparaiso is fifteen hundred and fifty-eight miles, head to wind all the time. The "Rimac" is now being repaired, and within a few months she will be again ready for sea.

1880.—A new pleasure-steamer, to be called the "Comet," is to be built for Lake Bigler. It will be exclusively for the use of passengers and pleasure-parties. It will make the trip around the lake in a day, and is to be fitted up in splendid style. It is to be ready for use next spring.

In 1880 the well-known American ship "Three Brothers," formerly the steamship "Vanderbilt," and one of the largest merchant-vessels afloat, was sold to merchants in Liverpool for eight thousand pounds, and she will hereafter sail under the British flag.

A MOUNTAIN STEAMER.—Steam navigation among the mountain ranges of Colorado is one of the peculiarities of that wonderful region. A Denver paper thus says: "A sail over the placid and translucent waters of Twin Lakes will convince the traveler that Colorado affords some of the most beautiful aquatic scenery in nature. Twin Lakes are located three miles from Twin Lake Station, Denver and South Park Division Union Pacific Railway, or one hundred and fifty-seven miles southwest of Denver, at the eastern base of the Sawache Range, at an elevation of nine thousand three hundred and thirty-three feet above the level of the sea. The lower lake covers fifteen hundred and twenty-five, and the upper four hundred and seventy-five acres, and they are united by a small, swift, clear stream, about half a mile in length, which winds through grassy meadows studded with scattering shade-trees, affording delightful picnic- or camp-grounds. On the north stands Mount Elbert, fourteen thousand three hundred and sixty feet above the sea, or five thousand and twenty-seven feet above the lakes. Directly opposite (at the south side of the lakes) are the Twin Peaks, also giants of the Rocky chain. The sheets are, therefore, thoroughly mountain-locked." The paper above quoted says the little steamer plying on Twin Lakes "has the distinguished honor of being nearer to heaven than any other craft in the wide, wide world."

SHIPS THAT WERE NEVER HEARD FROM.—The following European steamers have never been heard from after leaving port: The "President," sailed from New York March 11, 1841; had among her passengers Tyrone Power, the famous Irish comedian, and a son of the Duke of Richmond. The "Great Britain," lost in a storm on the

coast of Ireland, left Sept. 22, 1846. The "City of Glasgow," never heard from after leaving Glasgow in the spring of 1854; four hundred and eighty lives were lost. The "Pacific," never heard from after Jan. 23, 1856, when she left Liverpool; two hundred lives lost. The "Tempest," never heard from after she left New York, Feb. 26, 1857. The "Connaught," burned off the coast of Massachusetts, Oct. 7, 1860. The "United Kingdom," left New York April 17, 1869; eighty lives lost. The "City of Boston," left New York Jan. 25, 1870; about one hundred and sixty lives lost. The "Carolina" was wrecked on the Irish coast Nov. 29, 1863, and fifty lives lost. The "Ismailia" left New York Sept. 26, 1878, and was never heard from.

1880.—A CANAL-BOAT PROPELLED BY AIR.—A novelty in canal-boats lies in Charles River, near the foot of Chestnut Street, which is calculated to attract considerable attention. It is called a pneumatic canal-boat, and was built at Wiscasset, Maine, as devised by the owner, Mr. R. H. Tucker, of Boston, who claims to hold patents for its design in England and the United States. The specimen shown on Charles River, which is designed to be used on canals without injuring the banks, is a simple structure, measuring sixty-two feet long and twenty wide. It is three feet in depth, and draws seventeen inches of water. It is driven entirely by air, Root's blower No. 4 being used, the latter being operated by an eight horse-power engine. The air is forced down a central shaft to the bottom, where it is deflected, and, being confined between keels, passes backward and upward, escaping at the stern through an orifice nineteen feet wide, so as to form a sort of air wedge between the boat and the surface of the water. The force with which the air strikes the water is what propels it. The boat has a speed of four miles an hour, but requires a thirty-five horse-power engine to develop its full capabilities. The patentee claims a great advantage in doing away with the heavy machinery of screws and side-wheels, and believes that the contrivance gives full results in proportion to the power employed. It is also contrived for backing and steering by air propulsion. Owing to the slight disturbance which it causes to the water, it is thought to be very well adapted for work on canals without injury to the sides.—*Boston Journal*, October, 1881.

1880.—THE FIRST CHINESE STEAMER TO CROSS THE PACIFIC.—On the 31st of August, 1880, the Chinese steamer "Hochung" entered the custom-house of San Francisco, California, paying the regular tonnage dues of thirty cents per ton, and one dollar per ton extra dues on alien ships, the latter under protest. Extra duties of ten per cent. on the cargo were also paid under protest, and the whole matter was referred to the decision of the Secretary of the Treasury.

A San Francisco paper said of this arrival, under the heading, "China's Début upon the Sea":

"The arrival at San Francisco on the 30th of August of the first

Chinese steamer that has ever crossed the Pacific deserves commemoration. This steamer, the 'Hochung,' appeared at the Golden Gate, seeking admission to a foreign port, nearly forty years after the isolation in which for ages China was encased was broken and five of her ports were opened to the commerce of the civilized world. The treaty of 1842, by which this concession was secured to foreign trade, has borne fruit slowly; but the tardiness of the Chinese to undertake maritime enterprises is due not so much to their love of seclusion as to the difficulty of acquiring the art of navigation. This art is and ever has been one of the later acquisitions of nations. . . . It is no wonder, therefore, that the Chinese have taken forty years to master the nautical skill requisite for the accomplishment of this feat. But the beginning of ocean traffic is now made, and this field of commercial competition once fairly broken, there is reason to hope the Orientals will find it profitable. . . . In this maritime enterprise they are favored by the immense coal supply of the Middle Kingdom. Baron Richthofen, who carefully examined the coal-fields of China, says it is 'among the most favored countries of the world as regards the distribution of mineral fuel.' This able geographer computes from his own inspection that 'the quantity of very superior coal available for cheap extraction is so large that, at the present rate of consumption, the world could be supplied from Shansi alone for several thousand years.' This vast coal-bed is reached by the Yang-tse-Kiang (river), China's great commercial highway, navigable for large vessels twelve hundred miles from its mouth, and easily ascended by ocean steamers as far as Hankow, seven hundred miles from the sea. With such magnificent deposits of mineral fuel suited for use on steam-vessels, the day is not distant when the Chinese, renowned for ages as dextrous mechanics, will be able with a little nautical training to carve out a bright maritime future for their nation."

A telegraphic dispatch dated London, December 7, 1881, announced that "the 'Meifoo,' the first of a regular line of steamers under the Chinese flag, arrived in the Thames with three thousand tons of tea."

1880.—Mr. John Taggart, of Boston, in 1880 invented a method of propelling steamers by two screws, differing in almost every particular from the ordinary propeller. These screws are long, hollow iron cylinders, with what are called "gain" screws with two threads. The threads are near together at the bow, and gradually diverge towards the stern, thus giving the name of *gain* screw. By this means, it is claimed, a great power is gained at once at the bow, and the gradually-increasing width between the threads diminishes the friction and dead weight of the water to a great extent. The cylinders being hollow are very buoyant. The journals of these cylinders run in strong yokes projecting from the iron heel at the bow and stern. These cylinders are run by an endless chain. The threads are large and answer to the blades

of a propeller, but, having a greater surface, give an increased power. It is claimed that with these screws a river-boat could be run at the rate of *thirty-seven miles an hour;* that a tug thus equipped could with engines of the same power pull ordinary tugs backwards, and that an ocean steamer could cross the Atlantic in four and a half days. It is proposed to make a practical test of the invention by building a tug on the new plan.

1880.—The "Anthracite," the smallest steamer that ever crossed the Atlantic, arrived at New York in August, 1880, and went thence to Philadelphia. She sailed thence on the 23d of August, and arrived at Falmouth, England, September 14, after a voyage of twenty-two days and fourteen hours. She sailed three thousand three hundred and sixteen miles, doing the entire distance with the consumption of less than twenty-five tons of coal, and steaming thirteen hundred and fifty-three miles with only nine tons. The "Anthracite" is built with a new system of boilers, which, her inventor claims, will revolutionize the utilization of steam for propelling vessels.

The "Anthracite" was built expressly for this Atlantic voyage, to show that the difficulty heretofore encountered in vessels with high-pressure engines of retaining steam can be overcome by substituting for ordinary piston-packing a metal peculiar to the Perkins system. Economy in expenditure of heat and water is also claimed.

Of the eighty-four feet length of the "Anthracite," her engines, furnaces, and boilers take up a space of twenty-two feet six inches, leaving a hatchway, kitchen, and forecastle-cabin in the forepart of the boat, and a water-tight bulkhead. Abaft the engines are three cabins, with sleeping-bunks, and a water-tight bulkhead in the stern. The screw is of the ordinary fish-tail pattern, with two blades. Her gross tonnage is 70.26 tons, and her registered tonnage is 27.91 tons. Her average consumption of coal on the voyage from England to Newfoundland and thence to New York was one ton of Welsh bituminous coal a day. The weather was very rough, consequently the sails could be little used. The counter registering the revolutions of her screw was set at 0 before she left England, and on arrival marked three million nine hundred and eighty thousand. In the voyage over the furnace was operated, the natural draught only being used, but there she has a fan-blower, which can be brought into use if increased consumption of fuel and a higher pressure of steam are desired.

The peculiarity of the machinery which effects the economy of fuel lies in the means employed for using steam at very high pressure safely, and without undue wear and strain. The average boiler pressure on the voyage over was from three hundred and fifty to four hundred pounds to the square inch, but the boilers had been tested up to two thousand five hundred pounds per square inch by hydraulic pressure. The body of the boiler consists of a series of horizontal tubes, welded

up at each end, and connected together by a vertical tube, and the several sections are connected by a vertical tube to the top ring of the fire-box, and by another to the steam collecting-tube. The fire-box is formed of tubes bent into a rectangular shape. The boiler is surrounded by a double casing of thin sheet-iron, filled up with non-conducting material to prevent loss of heat. The cylinders and valve-boxes are steam-jacketed, and further protected by jackets of non-conducting material, so that, although all the parts are kept at a high temperature, the heat given out in the engine and fire-room is much less than is usual in ordinary marine engines.

The difficulty from friction and imperfect joints in practically working machinery at high pressures was one of the serious obstacles encountered in developing this system. After a long series of experiments, the inventor adopted an anti-friction alloy, of which the packing-rings and internal rubbing surfaces are made. No lubrication is required beyond that furnished by the steam. He states cylinders fitted with piston-rings made of this metal have been several years at work, showing no signs of wear, the only wear occurring on the rings, which can be easily and cheaply replaced. Not only is the cost of oil and grease saved, but the destructive action on the machinery and boiler of the acids generated from lubricants is avoided.

For the use of steam at these high pressures three different-sized cylinders are employed, all jacketed with spiral tubes cast in the metal, which are supplied with steam direct from the boilers, and keep up the temperature of the cylinders. The cylinders are arranged one above the other, and their pistons are connected to a common piston-rod. The operation is thus described by Mr. Loftus Perkins, the inventor, in a paper read before the Institution of Mechanical Engineers, London:

"The high-pressure steam is introduced into the upper end of the first cylinder, where there is no gland, and where the piston is formed so as to require no lubricating material. The steam is cut off at half-stroke in this cylinder, and when admitted for the return-stroke into the bottom of the second cylinder, of four times the area, the temperature is so much reduced as to cause no difficulty when brought into contact with the piston-rod gland. From the bottom of the second cylinder the steam expands into the top of the same cylinder, which is of larger capacity than the bottom, and serves as a chamber, and is in direct communication with the valve-box of the third cylinder. This last is double-acting, and is arranged to cut off at about a quarter-stroke, and at the termination of the stroke exhausts into the condenser, with an expansion of about thirty-two times."

Although it is some years since Mr. Perkins began to advocate the merits of this system, and he has taken out many patents connected therewith, the difficulties attending its practical working, and the disposition to oppose it by those who had large sums invested in old-style

machinery, have prevented its general adoption, although in several cases in England it has been successfully introduced. The boilers and engines of the "Anthracite" contain all the latest improvements of the inventor, and it is believed they afford a practical demonstration of the entire success of the Perkins system, and show how all stationary and marine engines can be run at an expense of less than one-half the present cost for fuel.

Two and a half pounds of coal per horse-power per hour is considered very economical running, and some of our best-managed ocean steamers use one hundred tons of coal a day in their voyage. To demonstrate the practicability of reducing this more than one-half, thereby not only saving the cost of fuel, but giving more space for freight, is the purpose of the visit of the "Anthracite" to American waters.

1881.—"The steam-cutter 'Harriet Lane,' built in 1859 for the revenue service, was placed at the disposal of the Prince of Wales during his visit to this country, and at the outbreak of the Rebellion was turned over to the Navy Department. On New Year's night, 1863, her decks were the scene of one of the most desperate hand-to-hand encounters of the war. Transformed into a bark and rechristened the 'Elliott Richie,' this famous craft was peacefully lying at Philadelphia awaiting a cargo, December 10, 1881."

1881.—The steamer "Dessong," which conveyed Cleopatra's Needle from Egypt to New York, was built in England, and was for many years used as a trader before the Khedive of Egypt bought and converted her into a private yacht. Purchased for the purpose of bringing the obelisk to America, she has since been sold and altered and rebuilt for the New York and Savannah cotton trade.

1881.—A hydraulic ship has been built in Germany, and on her trial accomplished nine knots an hour. Two hundred years ago the experiment was made of propelling vessels by expelling water from the stern, and failed, as sufficient speed was not attained. The new method was based on the assumption that the propelling force depends on the contact of surfaces, and not on the sectional area of the flowing mass, so a number of tubes with narrow outlets are used instead of one large tube.

1881.—A steam-yacht with a novel propelling power was built this year. Instead of a screw, as in ordinary propellers, there is a flat blade of iron under the rudder at right angles to the keel. This blade is hinged in the centre. The blade works backwards and forwards on a hollow shaft, with a stroke of three feet forward and aft. As the blade moves forwards under the overhang of the vessel, by means of an inside shaft, it shuts up, and affords no resistance to the water. When it goes back again it opens, and virtually pushes the water astern. As the engine can work the blade with a stroke of one hundred and twenty to the minute, it is calculated that extraordinary speed will be attained.

The yacht is about thirty feet long over all, and is provided with a patent engine, resembling a pump-engine, with a pump-cylinder. The propelling-blade or pusher is three feet in length and fifteen inches wide.

1881.—The steamboat "Kittatinny," the first that ever reached Port Jervis, New York, arrived at Delaware Water Gap April 28, 1880, without accident, having run the fifty miles in less than five hours. This steamboat was sixty feet long, fourteen feet wide, and carried seventy persons, the navigation of the Upper Delaware being thus proved feasible at last. Great excitement prevailed throughout the region traversed, hundreds of persons flocking to see the boat.

THE FALL RIVER LINE—1881.—The "Bristol" and "Providence," of the Fall River Line of Sound steamers between Boston and New York, for size, proportions, and general magnificence of appointments, have attracted the attention and admiration of travelers from every portion of the world. They are three hundred and seventy-three feet long, eighty-three feet beam, three thousand tons register, and cost one million two hundred and fifty thousand dollars each. During the Centennial season, 1876, the passengers carried in safety and comfort by these mammoth steamships were numbered by hundreds of thousands. Over one thousand persons frequently made the trip in one of these steamers without discomfort or crowding. The fresco-work and gilding of the interior is elegant and elaborate, the shading and coloring having a most harmonious and beautiful effect. The main saloons, galleries, and cabins are carpeted richly and tastefully, and the furniture elegantly upholstered. All the state-rooms are connected with the main office by electric bells. Some idea of the size of these engines may be formed when it is stated that the Corliss engine which attracted so much attention at the Centennial was not one-half the size nor had one-half the capacity of the engines on either the "Bristol" or "Providence." In provisions for safety the arrangements are perfect. Every portion of the boats where fire is used is absolutely fire-proof, and each steamer is provided with all the improved life-saving appliances.

"The 'Puritan,' the new steamer now being constructed in Roach's yard for this line, is to have three hundred state-rooms and accommodations for one thousand passengers, and is to be fifteen feet longer and four feet wider than the 'Bristol.' She is to be three hundred and eighty-four feet long,—three hundred and seventy feet long at water-line,—eighty-seven feet wide over guards, and seventeen feet six inches deep at sides. The double hulls will be divided into ninety-six water-tight compartments, bearing a pressure of five pounds per square inch. Steam will be supplied from four Redfield boilers, and there will be one immense beam-engine, having a cylinder one hundred and ten inches in diameter, with fourteen feet stroke. This cylinder was cast at Mr. Roach's Morgan Iron Works, in New York, and it is

said to be the largest cylinder ever cast in this country. It required forty-five tons of gun-metal, which it took three hours and ten minutes to melt. The ninety thousand pounds were then transferred by the labor of one hundred men to two huge tank-ladles, each having a capacity of about fifteen tons, and two large crane-handles. The tanks were connected with the mould by pipes, and the crane-handles were attached to huge cranes. The mould was filled, under Mr. Roach's personal supervision, in two and a half minutes, the molten metal roaring like a wild beast, and emitting showers of twenty colors. It will require about ten days for the metal thoroughly to cool, and for several days it will remain red-hot. When perfectly solidified the upper part of the mould will be demolished, and the cylinder will then be dug from its resting-place in the ground. The two main shafts for this engine will be forty feet long and twenty-seven inches in diameter, forged from wrought iron, and each will weigh eighty-five thousand pounds. She is expected to be ready for service by May, 1882."

1881.—As the tonnage of the merchant steam marine increases, so do the disasters of steam-vessels grow. The records of 1881 show the disasters to steam-vessels reported for the year to have been one hundred and ninety-eight. Of these, a dozen vessels have been repaired and put into service, but nearly all were total wrecks. A few were also sunk at their piers through carelessness while loading or discharging cargoes, as in the case of the "Braunschweig," loading coal in the harbor at Bremen. Others have been stranded and floated off without receiving damage. Included in the record for 1881 is the loss of the Polar expedition steamer "Jeannette," in the Arctic Ocean, on June 11.

The record for 1881 shows that of the disasters one hundred and forty-one were to British steamships; fifteen were American; six French; six Danish; five German; three Dutch; four Swedish; one Brazilian; three Belgian; four Spanish; two Chilian; Mexican, Chinese, Austrian, Japanese, and Norwegian, one each; of three the nationality could not be learned. Of these, four were of steel, five of wood, and the remainder iron vessels. The total tonnage lost in 1881 was two hundred thousand tons, of which one hundred and fifty-one thousand and forty-one tons were British; eleven thousand five hundred and sixty-eight American; four thousand three hundred and ninety Dutch; two thousand four hundred and eighty-eight Swedish; one thousand Brazilian; six thousand four hundred and eighty-six French; four thousand six hundred and forty-three Belgian; three thousand two hundred and seventy-four Danish; four thousand five hundred and sixty-two German; four thousand one hundred and seventy-seven Spanish; six hundred and eighty Mexican; twelve hundred and thirty-three Chinese; eight hundred and eight Austrian; nine hundred and forty-seven Japanese; six hundred and ninety-seven Norwegian, and

seventeen hundred and fifty Chilian. Of the disasters, ninety-nine vessels were stranded; thirty sunk by collision; forty foundered; seven burned; eleven are missing; six were abandoned at sea; two were sunk by ice; one broken in two, and one was destroyed by explosion. Eleven of the vessels were laden with grain; twenty-three with coal; eleven with iron; two with cotton, and one each with copper ore, petroleum, provisions, wool, and sugar.

The greatest number of disasters was in October; the records for that month are unprecedented. The total number of steamships lost in October was thirty-two, of which eighteen were British; France, Germany, and Norway lost two each; Austria, Belgium, Brazil, Chili, Holland, Russia, Spain, and Sweden, one each. Of sailing-vessels there were two hundred and thirty-six lost, including eighty-four British, forty Norwegian, twenty-seven German, seventeen French, fifteen Swedish, eleven Italian, ten Dutch, ten Russian, and five American. It is estimated that no less than forty-three thousand and thirty-three tons of produce were lost in the October gales, but most of the vessels lost were coal-laden.

The steamship "Bath City" foundered off the coast of Newfoundland December 3, and the sufferings of the crew were terrible. Sighted on November 30, two hundred and fifty miles from the port of St. John's, Newfoundland, by a steamship which could have assisted her into port, the vessel was left, mastless, rudderless, and leaking, to her fate, which came three days afterwards. The vessel went to the bottom, and the crew were launched on the stormy ocean in their life-boats. Four were drowned by the capsizing of one of the boats, and six, including the captain, perished from cold and exposure. The other castaways, having suffered three days and nights in open boats, were rescued in a deplorable condition by a sailing-vessel.

TABLE *showing the Steam-Vessels built in the United States during the fiscal year ending June* 30, 1879.

Class of Vessels.	Number.	Tonnage.
River steamers, side-wheel	55	23,688.40
" " stern-wheel	121	27,038.85
" " propellers	129	6,465.83
Lake steamers, side-wheel	2	2,219.83
" " propellers	15	8,092.64
Ocean steamers, propellers	13	18,905.80
Total	335	86,361.35

TABLE *showing Number and Tonnage of Iron Steam-Vessels built in the United States during the fiscal year ending June* 30, 1879.

Ports.	Number.	Tons.
Philadelphia, Pa.	15	17,318.24
Pittsburgh, Pa.	1	44.49
Wilmington, Del.	6	4,010.72
Baltimore, Md.	2	634.36
Total	24	22,007.81

TABLE *showing the number of Steam-Vessels built in the United States, and the Registered, Enrolled, and Licensed Steam Tonnage of the Merchant Marine of the United States, from* 1828 *to* 1879.

(Compiled from Official Sources)

Year Ended.	No. Built.	Registered.	Enrolled.	Total.	Year Ended.	No. Built.	Registered.	Enrolled.	Licensed under 20 Tons.	Total.
					June 30.					
Dec. 31, 1823...	15	.....	24,879	24,879	1852	259	79,704	563,536	.....	643,240
" 1824...	26	.....	21,610	21,610	1853	271	90,520	514,098	.....	604,618
" 1825...	35	.....	23,061	23,061	1854	281	95,036	581,571	.....	676,607
" 1826...	45	.....	34,059	34,059	1855	243	115,045	655,240	.....	770,285
" 1827...	38	.....	40,198	40,198	1856	221	89,715	583,362	.....	673,077
" 1828...	33	.....	39,418	39,418	1857	263	86,873	618,911	.....	705,784
" 1829...	43	.....	54,037	54,037	1858	226	78,027	651,363	.....	729,390
" 1830...	37	1,419	63,053	64,472	1859	172	92,748	676,005	.....	768,753
" 1831...	34	877	68,568	69,445	1860	264	97,206	770,641	.....	867,937
" 1832...	100	181	90,633	90,814	1861	264	102,608	774,596	.....	877,204
" 1833...	65	545	101,306	101,851	1862	183	113,998	598,465	.....	710,463
" 1834...	88	340	122,474	122,814	1863	367	133.215	442,304	.....	575.519
Sept. 30, 1835... (9 months.)	30	340	122,474	122,814	1864	498	122,006	855,954	.....	977,960
Sept. 30, 1836...	124	454	145,102	145,556	1865	411	98,008	969,131	.....	1,067,139
" 1837...	135	1,104	153,661	154,765	1866	348	198,289	885,223	.....	1,083,512
" 1838...	90	2,791	190,632	193,423	1867	180	198,115	993,765	.....	1,191,880
" 1839...	125	5,149	189,879	195,028	1868	236	221,939	975,142	2,334	1,199,415
" 1840...	63	4,155	198,184	202,339	1869	277	213,252	887,401	2,915	1,103,568
" 1841...	78	746	174,342	175,088	1870	200	192,544	879,522	3,029	1,075,095
" 1842...	137	4,701	225,050	229,751	1871	302	180,914	903,543	3,180	1,087,637
June 30, 1843.. (9 months.)	79	5,373	231,494	236,867	1872	292	177,666	929,962	3,925	1,111,553
June 30, 1844..	163	6,910	265,270	272,180	1873	402	193,423	958,417	4,603	1,156,443
" 1845..	163	6,492	319,527	326,019	1874	404	195,245	985,569	4,796	1,185,610
" 1846..	225	6,287	341,606	347,893	1875	323	191,889	971,806	5,173	1,168,868
" 1847..	198	5,631	399,210	404,841	1876	338	198,227	968,300	5,845	1,172,372
" 1848..	175	16,068	411,823	427,891	1877	265	190,133	975,033	6,031	1,171,197
" 1849..	208	20,870	441,525	462,395	1878	334	170,838	990,382	6,458	1,167,678
" 1850..	159	44,942	481,005	525,947	1879	335	156,323	1,012,810	7,039	1,176,172
" 1851..	233	62,390	521,217	583,607						

STEAM-VESSELS OF THE UNITED KINGDOM, 1850–80.[1]

YEARS.	Home Trade.			Partly Home and Partly Foreign Trade.			Employed in Foreign Trade.			Built.	
	No.	Men.	Tons.	No.	Men.	Tons.	No.	Men.	Tons.	No.	Tons.
1850.....	.....	.....	.....	.....	.....	5,298	.....	.....	45,186	68	14,584
1860	.....	.....	.....	.....	.....	29,803	.....	.....	277,437	198	53,796
1861.....	.....	.....	.....	.....	.....	24,924	.....	.....	313,465	201	70,869
1862.....	.....	.....	.....	.....	.....	29,463	.....	.....	328,310	221	77,338
1863.....	.....	.....	.....	.....	.....	33,547	.....	.....	371,201	279	107,951
1864.....	.....	.....	.....	.....	.....	36,944	.....	.....	450,241	374	159,374
1865.....	.....	.....	.....	.....	.....	43,225	.....	.....	523,698	382	179,649
1866.....	612	9,005	147,184	110	2050	47,194	784	28,748	553,425	354	133,511
1867.....	657	9,451	154,244	125	2249	50,201	834	31,411	608,232	295	97,219
1868.....	729	9,755	153,265	134	2339	52,150	862	31,568	619,199	232	79,096
1869.....	751	10,049	161,984	164	3048	73,964	810	30,207	644,080	281	123,203
1870.....	1071	11,445	170,746	234	4221	108,813	935	33,089	760,410	434	226,591
1871.....	1191	12,613	195,125	300	5767	157,964	1066	40,323	936,914	537	330,798
1872.....	1237	13,238	208,490	244	4605	121,337	1364	48,776	1,185,877	635	415,961
1873.....	1096	13,243	215,263	221	3817	97,445	1479	54,302	1,368,245	509	363,917
1874.....	1128	13,323	219,550	221	3727	94,264	1597	57,823	1,513,210	482	333,890
1875.....	1183	13,479	231,722	322	5582	145,308	1465	54,366	1,470,158	357	178,905
1876.....	1345	14,664	247,255	287	4833	133,575	1489	53,330	1,480,964	320	123,475
1877.....	1323	14,378	241,253	255	4097	108,825	1640	54,524	1,627,411	389	221,330
1878.....	1324	14,447	243,092	246	3913	105,910	1820	57,140	1,811,024	499	287,080
1879....	1344	14,279	240,070	209	3153	84,496	2027	60,929	2,006,591	412	297,720

[1] Compiled from the Statesman's Year-Book, 1881, and official documents.

STEAM TONNAGE *belonging to the United States, British Empire, France, and Holland, from* 1838 *to* 1881, *showing the progress of steam tonnage since the advent of Ocean Steam Navigation.*

YEAR.	UNITED STATES.		Great Britain and its Possessions.	France.	Holland.	Total Steam Mercantile Marine of the Four Powers.
	Registered Foreign Trade.	Enrolled[1] Coasting Trade.				
1838.....	2,791	190,682	82,716	9,698	.....	285,882
1839.....	5,149	199,789	86,731	9,810	.....	301,479
1840.....	4,155	198,184	95,807	9,535	.....	307,681
1841.....	746	174,842	104,845	10,183	.....	290,116
1842.....	4,701	224,960	118,930	9,757	.....	358,348
1843.....	5,878	231,494	121,455	9,536	.....	367,858
1844.....	6,909	265,270	125,675	9,298	.....	407,147
1845.....	6,492	319,527	131,202	9,390	.....	466,611
1846.....	6,287	341,606	144,784	10,921	1,658	515,256
1847.....	5,631	399,210	156,557	12,567	1,976	575,941
1848.....	16,068	411,823	168,078	13,152	1,976	611,097
1849.....	20,870	441,525	177,310	13,391	3,836	656,482
1850.....	44,942	481,005	187,631	13,925	3,672	731,175
1851.....	62,390	521,217	204,654	19,460	3,692	811,671
1852.....	79,704	563,536	227,306	22,171	3,950	896,667
1853.....	90,520	514,098	264,336	26,399	4,452	899,808
1854.....	95,086	581,571	326,484	35,098	5,064	1,043,253
1855.....	115,045	655,240	408,290[2]	45,093	5,864	1,229,532
1856.....	89,715	583,362	417,717[2]	63,926	10,428	1,265,148
1857.....	86,873	618,911	458,966[2]	71,929	13,302	1,245,031
1858.....	78,027	651,363	488,415[2]	66,587	13,768	1,298,160
1859.....	92,747	676,004	472,764	65,006	14,340	1,320,861
1860.....	97,296	770,641	500,144	68,025	13,746	1,449,852
1861.....	102,608	774,596	561,028	73,267	13,012	1,524,506
1862.....	113,998	596,465	597,932	78,981	12,636	1,400,012
1863.....	133,215	489,755	657,026	84,918	13,994	1,328,908
1864.....	106,519	853,816	769,398	97,884	15,862	1,843,479
1865.....	98,008	969,131	902,052	108,328	15,068	2,092,587
1866.....	198,289	885,028	952,318	129,777	16,184	2,181,591
1867.....	198,115	993,765	973,415	133,158	20,604	2,319,147
1868.....	221,989	975,142	977,292	135,259	22,194	2,331,826
1869.....	213,252	887,401	1,033,247	142,942	22,568	2,299,410
1870.....	192,544	879,522	1,202,134	154,415	26,394	2,455,009
1871.....	180,914	906,728	1,411,803	160,478	36,644	2,696,562
1872.....	177,666	933,887	1,640,639	177,462	46,370	2,976,018
1873.....	193,423	963,020	1,825,738	185,165	50,560	3,217,906
1874.....	195,245	985,800	1,987,235	194,546	55,360	3,217,686
1875.....	191,689	971,806	1,847,218	.....	.....	.....
1876.....	198,227	968,300	1,870,794	.....	.....	.....
1877.....	190,133	975,033	1,977,489	.....	.....	.....
1878.....	170,838	990,382	2,160,126	.....	.....	.....
1879.....	156,323	1,012,810	2,331,157	.....	.....	.....
1880.....	146,604	1,058,587	.....	.....	.....	.....
1881.....	152,769	1,105,958	.....	.....	.....	.....

[1] The "Enrolled" tonnage of the United States is confined to the home and river trades, and is prohibited by law from going on a foreign voyage.

[2] In consequence of alterations in the system of measurement the British tonnage as compared with years previous to 1855 is a great deal less than if the old plan of measurement for tonnage had been continued. Changes of measurement have also taken place in the United States and the other countries. These figures, therefore, are only approximates, although derived from official sources.

New facilities for steam transportation have been devised, and year by year steam has gradually gained upon sailing-vessels. The statistics of the export business of New York with England, Scotland, Germany and the Netherlands, Belgium and France for the year ending June 30, 1880, show that the value carried in sailing-vessels was $73,029,677, as compared with $210,139,174 in steam-vessels, or in about the ratio of one to three. The figures for France and Holland for 1875–81 I have not been able to obtain.

AUSTRIAN STEAMERS.—The first Austrian Lloyd steamer for New York sailed from Trieste January 25, 1881. She was to touch at Messina, Palermo, Barcelona, Malaga, Cadiz, and Lisbon, and had on board a full cargo, six hundred tons of it being for New York.

A DANISH LINE.—The passenger steamship "Geyser," Captain Thompson, of the new Thingvalla Line, sailed from Copenhagen in December, 1881, on her first trip to New York. The Thingvalla Company is composed of Danish capitalists, foremost among whom is C. F. Tietgen, the founder of the Great Northern Telegraph Company, whose lines extend from England through Asia to the Pacific, and F. Kjoerboe. The steamship "Thingvalla" had for two years made irregular trips between Copenhagen and New York. The company put three new steamers on the stocks in Copenhagen and in Malmoe, Sweden; of these the "Geyser" and the "Hecla" have been finished, and the "Island" is about to be launched. The steamers are the largest ever built in Denmark. Their engines are of two thousand tons indicated horse-power, and are designed to make twelve knots an hour. The vessels are of three thousand tons burden, three hundred and twelve feet long, thirty-nine feet wide, and are calculated to carry forty cabin and seven hundred steerage passengers, and a crew of fifty men. Their route will be from Copenhagen around the northeast coast of Scotland, Christiansand, Norway, being their only stopping place. By going to the north of Scotland time will be saved, and it is expected that the steamers will make the trip to New York in thirteen or fourteen days. An effort will be made to secure the carrying of the mail between the United States and the Scandinavian kingdoms as soon as all the four steamers are running. Until the summer of 1882 the steamers will make fortnightly trips; after that, if desirable, the company's fleet will be increased.

The "Thingvalla" brought to New York as freight forty thousand head of cabbage that arrived in fair condition.

1882.—A WEST INDIA STEAMSHIP ENTERPRISE.—Señor Martinez de Campos, a lieutenant-general in the Spanish army, and a statesman of high reputation, has been elected president of a Cuban steamship company, which will confine its operations almost entirely to the West Indian islands. Of course this new enterprise will be liberally subsidized by the Spanish home government.

Seven or eight iron steamships are to be purchased or constructed in England, each to have a carrying capacity of at least two thousand five hundred tons. They will be fitted with all the modern conveniences necessary for capturing the large passenger traffic that has grown up between the islands.

Señor Campos proposes to run his ships to all the principal ports in the West Indies, to Central America, and to the northern coast of South America. They will carry cargoes of assorted goods entered in

bond at Havana, and from that port will distribute these goods among all the ports embraced in the sphere of operation marked out for the new line. The return cargoes will be composed of the products of the various islands and countries at which the ships will touch; and these cargoes will enter at Havana, to be distributed by other Spanish steam lines among the markets of the world.

A marked feature of the new enterprise is the design to secure, as far as possible, the service of free Cuban negroes for firemen and coal-passers, and as sailors only those who have passed through the "vomito," or whose residence in the tropics warrants the assumption of their thorough acclimation. If a sufficient number of free negroes cannot be obtained on the island, the captains of the vessels will be empowered to employ such persons of color residing on the other islands who will fill the requirements of the company in this sanitary respect.

By the employment of none but acclimated officers and seamen, the company believes it will economize both time and money. There are instances on record when ships have lost a part of their crews in one short voyage among the fever-stricken islands, and have been laid up in some out-of-the-way port until hands could be procured to work them. Passengers, also, would rather travel in vessels thus manned, for when sickness breaks out on board a ship it almost always makes its first appearance among the crew, who are more exposed to the heat of the sun than the passengers, who are protected from its rays by awnings.

Mr. De Campos's new enterprise will receive government help the moment the first ship puts to sea.

1882.—THE "COLOSSUS."—The latest addition to the British Royal Navy is the double-screw steel armor-plated turret-ship "Colossus," launched at Portsmouth, March 21, 1882. She is of nine thousand one hundred and forty-six tons burden, and her engines are of six thousand horse-power,—a striking advance upon Fulton's "Clermont," the wonder of three-quarters of a century ago.

The "Colossus" has been in the process of construction for some eight years past, but the work on her has been seriously pressed only since 1879. She is a twin-screw turret-ship, with a central armored citadel, her principal dimensions being: total length between the perpendiculars, three hundred and twenty-five feet; and extreme breadth, sixty-eight feet, with a displacement of nine thousand one hundred and forty-six tons. Considerable delay has been experienced with respect to the turrets, which cannot be proceeded with until the nature of their armament is determined. It is probable that each turret will be armed with two of the new 46-ton breech-loading rifle guns. A novel feature in the armament of the ship will be the mounting of four 6-inch guns on the top of the after superstructure, and a couple of guns on the for-

ward superstructure, with rifle-proof covering-boards for the protection of the gunners.

The vessel is to be fitted with a manganese bronze propeller, in place of the one of gun-metal originally ordered. This decision was arrived at after a series of comparative experiments made with the two metals. Bars of both metals, one inch square, were placed on supports twelve inches apart, and first subjected to a steady pressure applied in the middle of the bars, and afterwards to impact by a weight of fifty pounds falling from a height of five feet. With a steady pressure the gun-metal bars slipped between the supports or broke with a strain of twenty-eight hundred-weight, while the manganese bronze bars required fifty-four hundred-weight to break them. Tested by impact, the gun-metal bars broke with from seven to eight blows, while it took from thirteen to seventeen blows to break the manganese bronze bars. The ultimate bend of the latter was also in both cases more than that of the gun-metal, thus showing fully double the strength with superior toughness. The advantages claimed for manganese bronze over gun-metal are, first, a considerable saving of actual weight of machinery; and, secondly, that it enables a thinner and consequently a better blade to be made, offering less resistance to the water, and equaling in strength the gun-metal blade of greater dimensions.

Since the launch of the "Colossus," another ironclad, to be called the "Rodney," has been laid down and commenced at the Chatham Dock-Yard. She is to be a barbette ship, and will carry ten heavy guns. Her length between the perpendiculars is 325 feet; extreme breadth, 68 feet; depth of hold, 28 feet 2½ inches. She is to have engines of 7000 horse-power, and will have a gross tonnage of 9158 tons.

THE PACIFIC STEAM NAVIGATION COMPANY—1840.—The first steamer on the Pacific coast was a small craft named the "Telica," commanded and owned by a Spaniard named Mitrovitch, but his career and that of his vessel was a short and melancholy one. In a fit of despair at his want of success he fired his pistol into a barrel of gunpowder, blowing up his vessel in the harbor of Guayaquil, and destroying himself and all on board except one man. This lamentable occurrence retarded the introduction of steam on the Pacific coast. But Mr. William Wheelright, a native of Newburyport, Massachusetts, then United States consul at Guayaquil, saw the great advantages of steam communication along the coast and between the several South American republics, and spent six of the best years of his life in arranging for such communication. Failing to obtain the needed aid and encouragement for his plans in the United States he proceeded to England, and on the 17th of February, 1840, just about the time that Transatlantic steam navigation was an assured success, he obtained, "under letters patent," a charter for the establishment of the Pacific Steam

Navigation Company, with a small subsidy for the conveyance of the British mails. The capital of the company was at first limited to two hundred and fifty thousand pounds, in five thousand shares of fifty pounds each. The whole capital was subscribed for, but only an amount was called up sufficient at the time to enable the directors to provide two boats,—the "Chili" and "Peru,"—which were dispatched to commence operations towards the close of 1840. These vessels were wooden paddle-wheel steamers, sister-ships of about seven hundred tons gross register, though with a capacity of not half that tonnage, with engines of about one hundred and fifty horse-power, their extreme length being one hundred and ninety-eight feet and extreme breadth fifty feet.[63] They were at that time considered fine vessels, and on their arrival at Valparaiso they were received with great rejoicings and with salvos of artillery, everybody wishing to visit them, "the president of the republic, accompanied by his ministers, being among the first to welcome the steamships to the shores of the Pacific."

The company in its early days had many difficulties to overcome, the scarcity of fuel being one of the greatest, and during the first five years sustained a loss of no less than seventy-two thousand pounds upon a paid-up capital of ninety-four thousand pounds. In face of this heavy loss the shareholders resolved to persevere, and in December, 1847, the directors were enabled to give to the shareholders for the first time a dividend, though only two and one-half per cent., on their paid-up capital.

In 1850, four new steamers, viz., the "Lima," "Santiago," "Quito," and "Bogota," of one thousand tons and two hundred horse-power, each in pursuance with a contract with Admiralty, and costing one hundred and forty thousand pounds, were added to the line, to be employed in the bi-monthly service between Valparaiso and Panama.

From 1860 the trade of the Pacific rapidly developed. Steam here as elsewhere opened up new and hitherto unthought-of branches of commerce, and from that date the progress of the company has been of unexampled success.

In 1865 the chartered powers of the company were extended to the establishment of lines "between the west coast of South America and the river Plata, including the Falkland Islands and such other ports or places in North and South America and other foreign ports as the said company shall deem expedient."

The directors by degrees applied the compound engine after 1856 to all their steamships, and it is worthy of record that they were not only among the first, if not the first, to adopt the compound engine for ocean-going steamers, but were almost singular in this respect for upwards of fourteen years.

[63] Lindsay's Merchant Shipping, vol. iv., has an illustration of the pioneer steamer "Peru."

During these years the profits of the undertaking had been steadily increasing, and at a special meeting of the shareholders, held December, 1867, it was determined to add to the operations of the company a *monthly* line *from Liverpool* to the west coast of South America *via* the Straits of Magellan.

This entirely new and important though hazardous branch of the service necessitated an increase of the capital of the company to two million pounds. In furtherance of their views the "Pacific," of two thousand tons register and four hundred and fifty horse-power, was sent from Valparaiso in May, 1868, as the pioneer of the new mail line.

The project was successful, and in 1869 the profits of the four new steamers, which had made nine voyages from Liverpool to Valparaiso, were so satisfactory that in 1870 it was determined to extend the voyage from Valparaiso to Callao. Seventeen voyages made in the course of that year with still greater success induced the directors to recommend that the departures thenceforward should be three a month; and in December, 1871, the capital was authorized to be increased to three million pounds, so that the company might be enabled to dispatch every week one of their steamers on this distant voyage.

In July, 1872, the capital was increased to four million pounds.

In 1877, when in command of the United States squadron in the South Pacific, I wrote a letter to the Department, in which I gave the following information with regard to the then condition of this line:

"I forward herewith an advertisement exhibiting the names and tonnage of the forty-eight vessels which now compose the steam fleet of the English 'Pacific Steam Navigation Company' on this coast. A few of these vessels have paddle-wheels, but nearly all are iron screw-steamers of power, speed, and good model. Relieved of their light passenger decks and armed they would in the event of war prove an efficient and formidable auxiliary to the British naval force in these seas as cruisers and 'commerce destroyers.' The schedule and average speed of the coasting steamers of this company, ten knots, is considered their *economical* rate of steaming.

"The *eighteen* steamers of the 'Straits' line are bark-rigged, have an average tonnage greater than the five 'first-rates' of our navy, are superior to them in speed, are capable of being as heavily armed. In addition to a profitable freight, they carry coal for *forty* days, steaming at the rate of eleven knots per hour under all conditions of wind and weather, the latter a good desideratum for a country, like the United States, having no colonies, and its ships dependent upon home ports for a supply of coal, which are now classed as 'contraband of war.'

"The following memorandum of the performance of the 'Aconcagua,' one of the steamships of the Straits line, I took from her abstract log by permission of her commander.

"The Pacific Steam Navigation Company's steamship 'Aconcagua,'

4106 tons, left Liverpool, June 13, 1877, at 8 P.M., and arrived at Callao, Peru, August 9, 1877, at 7 A.M., stopping in the voyage at Pauillac, Lisbon, St. Vincent, Rio Janeiro, Montevideo, Sandy Point, Valparaiso, Arica, and Mollendo, the time occupied on the voyage being 56 days, 5 hours, 50 minutes; the actual *steaming* time, 40 days, 11 hours, 35 minutes. The distance run was 11,033 nautical miles. Coal consumed, 1900 tons. She also expended 656 gallons of oil, 132 pounds of tallow, and 74 pounds of waste. She received on board at Liverpool 1746 tons of coal, and at St. Vincent, 750 tons.

"The following was her expenditure of coal between the several ports stopped at:

Liverpool to Pauillac . .	139 tons.	Sandy Point to Valparaiso .	295 tons.
Pauillac to Lisbon . . .	148 "	Valparaiso to Arica . .	147 "
Lisbon to St. Vincent . .	256 "	Arica to Mollendo . .	22 "
St. Vincent to Rio Janeiro .	461 "	Mollendo to Callao . .	66 "
Rio Janeiro to Montevideo .	155 "		
Montevideo to Sandy Point .	211 "	Total	1900 tons.

"The average of her voyage,—speed, 11.36 knots; revolutions, 50.75 per minute; pressure, 63; coal, 46.91 tons per day. The least average speed made in any twenty-four hours during the voyage was 9.6 knots.

"On her previous voyage the 'Aconcagua' touched at one less port, ran 11,003 nautical miles, and consumed 1776 tons of coal. The 'Aconcagua' has but one smoke-stack, others of the line have two. The Straits steamers with steam-cutters, and all the ships of the company are furnished with steam-capstans."

Mr. Lindsay, in his "History of Merchant Shipping," vol. iv., published in 1876, says the company at that date owned 54 steamers of an aggregate of 119,870 tons and 20,395 horse-power. Two of these, the "Iberia" and "Liguria," built in 1873, were each 4671 tons gross register, with a capacity for 4000 tons of cargo, space for 916 tons of coal additional, and accommodation for 800 third-class passengers. On their trial trips these steamers attained a speed of 15 knots per hour. Their length is 425 feet between perpendicular, and 449 feet over all. Their breadth is 44½ feet, depth of hold 35½ feet. The engines, which are compound, have each *three* cylinders, one of 4 feet 8 inches diameter, and two of 6 feet 6 inches diameter, with 5 feet length of stroke.

When we consider that the tonnage of the navy of the United States in 1881, distributed in 22 sailing-vessels, 83 screw-steamers, 26 ironclads, and 7 side-wheel steamers, in all 138 vessels of every class and type, amounts to only 143,338 tons, it may be profitable to compare it with the 120,000 tons of this private company, invested in steam-vessels combining the latest improvements in machinery for economy and speed.

The services of the steamers of this company on the west coast have

of late been subjected to the depressing influences of the war between Chili and Peru; but the steam trade of the Pacific has steadily and marvelously increased since first opened out by the energy of our countryman, Wheelright. The people of Chili, sensible of their indebtedness to him, have erected a bronze statue to his honor in one of the principal plazas of Valparaiso.

The commanders, officers, and engineers of this company are all Britons. The company are owners of an island in the Bay of Panama, where they have constructed a *gridiron* for hauling up their vessels for cleaning or repair. They have also to effect these objects erected shops at Callao, fitted with the requisite apparatus, implements, and tools, and maintain a staff of well-trained workmen.

Connected with the establishments at Callao, Panama, and Valparaiso, the company contributes liberally to the support of schools, and for the maintenance of clergymen of the Established Church; and it is also interested in the iron floating-docks at Valparaiso and Callao.

The splendid and, we may say, stupendous results of this company are the outgrowth of the project of the American, William Wheelright, who, after presenting his plans to the capitalists of New York and being rejected by them, presented them in Liverpool, where they met with better success. Thus through the far-seeing of our English brethren the sceptre of the commerce of the Pacific passed into their hands, and it will require on our part, notwithstanding the predilection our South American cousins have for us, a long pull, a strong pull, and a pull all together before we can regain it.

THE PENINSULAR AND ORIENTAL STEAM NAVIGATION COMPANY—1840.—The career of this company, the first to undertake to convey the mails overland to the East, is interesting. During the earlier part of its career, by agreeing to carry the Peninsular mails for a sum considerably less than the Admiralty packets, with a speed and regularity hitherto unknown, it conferred an undoubted boon upon the public.

In 1815, Mr. Brodie McGhee Wilcox, a young man without influence and but limited pecuniary means, commenced business in London as a ship-broker and commission merchant. He soon after engaged a youth from the Orkney Islands, Arthur Anderson, as his clerk, who became his partner in 1825, under the title of Wilcox & Anderson. In 1834 the Dublin and London Steam Packet Company chartered the steamer "Royal Tar" to Dom Pedro through the agency of the firm. Soon afterwards the Spanish minister in London induced Messrs. Bourne, of Dublin, to put on a line of steamers between London and the Peninsula, for which Wilcox & Anderson were appointed agents. A small company was formed to carry out this undertaking. Previously to September, 1837, the Peninsular mails were conveyed by sailing-packets, which left Falmouth, England, for Lisbon every week,

"wind and weather permitting." The Peninsular company of steam-packets, some little time established, on the 29th of August, 1837, contracted to convey the Peninsular mails for £29,600 per annum, subsequently reduced to £20,500 per annum. This service may be considered the nucleus of the great company which now conveys the mails to all parts of the Eastern world. The "Iberia," the first steamer dispatched with the Peninsular mails, sailed in September, 1837.

The mode in which the mails were conveyed to and from India up to September, 1840, was by steamers plying monthly between Bombay and Suez, and thence by British government steamers from Alexandria to Gibraltar, where they received the mails brought out by the Peninsular Company from England. In 1839 the British government entered into a convention with the French government for the sending of letters to and from India through France by way of Marseilles. The irregularities that ensued caused the British government to apply to the managers of the Peninsular Company to run a line of superior steamers direct from England to Alexandria, and *vice versa*, touching only at Gibraltar and Malta. The vessels approved by the Admiralty were the "Oriental," of 1600 tons and 450 horse-power, and the "Great Liverpool," of 1540 tons and 464 horse-power, which was originally intended for the Transatlantic service. These were now dispatched with the mails from England to Alexandria, Egypt, thus combining the two mail services and constituting the Peninsular and *Oriental* Steam Navigation Company. In 1842 the East India Company contracted with the Peninsular Company to establish a line of steamers between Calcutta and Suez, and September 24, 1842, its new ship "Hindostan," of 1800 tons and 520 horse-power, was sent from Southampton to open a line between Calcutta, Madras, Ceylon, and Suez. The government went into another contract with the company for a monthly service from Ceylon to Penang, Singapore, and Hong Kong, and in 1854 the company undertook another line between Bombay and Suez. They next extended a line between India and the Australian colonies. All these lines were heavily subsidized. The urgent requirements of government for the conveying troops to the Black Sea and the Baltic on the outbreak of the Crimean war obliged the company, towards the close of 1854, to discontinue the line to Australia, and to reduce the Bombay and China service from a fortnightly to a monthly line. During the Crimean war this company had eleven of their steamers, measuring 18,000 tons, in the transport service, which conveyed during the continuance of hostilities 1800 officers, 60,000 men, and 15,000 horses. The "Himalaya," the largest vessel of the line at this time, was 340 feet in length, 44½ feet width of beam, and her engines were 2050 indicated horse-power. She was 3540 tons, old measurement, and cost £132,000 complete for sea.

Thus, step by step, the company advanced, until we learn from its

annual report ending September 30, 1874, its paid-up capital amounted to £2,700,000 and £800,000 debenture stock, and that it was the intention during the year to increase it up to £4,300,000, of which £600,000 would remain unpaid. Of this capital, £3,757,000 consisted of stock in ships; £221,000 of freehold and leasehold property and docks and premises in England, Calcutta, Bombay, Singapore, Hong Kong, and other stations; and £413,000 in coal and naval victualing stores. Its fleet at the same time consisted of 50 sea-going steamers, measuring 122,000 tons, and of 22,000 horse-power,—thirty-four being employed in the Mediterranean, Adriatic, India, and China services; four in the Australian service between Ceylon, Melbourne, and Sydney; five in the China and Japan local services; two used as cargo vessels; five undergoing repairs and in reserve. The company also possessed twelve steam-tugs and three cargo- and coal-hulks, and gave permanent employment to 12,600 persons, exclusive of coal laborers and coolies on shore; about 90,000 tons of coal are usually kept constantly in stock at its coaling-stations.

The iron screw steamship "Khedive," of this line, built in 1873, is of the following dimensions: Length, 380 feet; breadth, 42 feet; depth, 36 feet. Her builders' measurement is 3329 tons; her gross register, 3742 tons; and her net register, 2092 tons. She is fitted to accommodate with the space and style now required for Eastern travel (how different to the space allotted to passengers in the ships of Nearchus!) 164 first-class and 53 second-class passengers. Has store-rooms to hold 380 tons; rooms for mails and baggage to contain 142 tons; bunkers to hold 846 tons of coal; and holds which can receive 2003 tons of cargo, of 50 feet to the ton. The contract price for the ship fitted complete for sea was £110,000. Her engines are compound, vertical, direct-acting, of 600 nominal horse-power, with 4 feet 6 inches length of stroke. The diameter of her cylinders, 69 and 96 inches respectively; and of her four-bladed screw, 17 feet 6 inches; its pitch being 22 feet 6 inches and 24 feet. She has 4 boilers and 16 furnaces. The fire-bar surface is 320 square feet, and the heating and condensing surface 11,720 and 6059 square feet respectively. The loaded pressure is 55 pounds on her boilers.

We have nothing in ancient times to compare with this model modern steamship, with her long, low hull, unless it be the rowing-galley, and to propel a vessel of the size and weight of the "Khedive" at the rate of four miles an hour through the smoothest water would require at least two thousand rowers, while the average speed of the "Khedive" on a voyage from Alexandria to Southampton, a distance of 2982 miles, was 10 knots, and on the return voyage 11 knots or nautical miles per hour.

THE ROYAL WEST INDIA MAIL STEAM PACKET COMPANY—1841.—Soon after the Atlantic Ocean began to be regularly navigated

by steam-vessels, the importance of a better means of intercommunication with the West Indies led to the formation of this company, which contracted with the Board of Admiralty in March, 1841, for the conveyance of the mails between England, the West Indies, and the Gulf of Mexico. It commenced operations on a much more comprehensive and grander scale than either the Cunard Company or Peninsular and Oriental. Fourteen large steamships were at once ordered to be built for the service; they were to be of such strength as would enable them to carry guns of the largest calibre then in use on board Her Majesty's war-steamers, with engines of not less than four hundred cohesive horse-power. The contract required one of these vessels to be ready to take the mails on board twice in each calendar month, and to proceed *via* Corunna and Madeira to the island of Barbadoes, and, after staying not more than six hours, thence *via* St. Vincent to the island of Grenada, where the stoppage was limited to twelve hours; thence in succession to Santa Cruz and St. Thomas, Tricola Mole, in Hayti, Santiago de Cuba, and Port Royal, in Jamaica. After a stay of not exceeding twenty-four hours at Port Royal, the steamer was to proceed to Savana la Mar, and thence to Havana; returning, she was to call at Savana la Mar, Port Royal, Santiago de Cuba, Tricola Mole, and Samana, in Hayti, delivering mails at each place, "care being taken that the said steam-vessel shall always arrive at Samana aforesaid (after performing the said voyage from Barbadoes under ordinary circumstances of wind and weather) on the twenty-second day after the arrival from England of the mails at Barbadoes," and after delivering and receiving the mails at Samana, "the steam-vessel shall make the best of her way back from Samana to such port in the British Channel as the said Commissioners of the Admiralty shall from time to time direct." In consideration of this service the company was to receive at the rate of two hundred and forty thousand pounds per annum in quarterly payments. Notwithstanding this large subsidy, the close of the first year's operations showed a loss of seventy-nine thousand seven hundred and ninety pounds, sixteen shillings, eight pence to the company.

By the original arrangements the annual mileage traversed would have been six hundred and eighty-four thousand eight hundred and sixteen miles. Government, however, in answer to the company's appeal, reduced the distance to be performed to three hundred and ninety-two thousand nine hundred and seventy-six miles, without reducing the subsidy. Though these liberal concessions had been made, they were more than counterbalanced by the loss of two valuable ships during the second year. Yet the trade increased so rapidly as to leave in 1843 a surplus of receipts over expenditures of ninety-four thousand two hundred and ten pounds, and in 1844 of one hundred and forty-seven thousand seven hundred and forty-nine pounds. From this time the prospects of the company have steadily improved. In 1850 the mail

contract was renewed for ten years from 1st January, 1852, the annual subsidy being increased to two hundred and seventy thousand pounds, the company agreeing to a monthly service to Brazil, and an increase of the mileage to five hundred and forty-seven thousand two hundred and ninety-six miles. The company was also required to increase the speed of the West Indian line from eight knots to ten knots per hour, and to add to their fleet five new steamers of two thousand two hundred and fifty tons and eight hundred horse-power each. In 1864 a third contract was entered into whereby the annual subsidy was reduced to one hundred and seventy-two thousand nine hundred and fourteen pounds, and the speed increased to ten and a half knots per hour in the West India Transatlantic service. In 1866 it was agreed each alternate fortnightly packet should proceed from St. Thomas direct to Colon (Aspinwall), instead of first touching at Jamaica, thus shortening the route between England and Panama.

In 1874 the annual subsidy for the conveyance of the West India mails was reduced to eighty-four thousand seven hundred and fifty pounds, not much more than one-third per cent. of what the company originally received.

In 1875 a contract was entered into with Her Majesty's government to carry on the Brazilian and River Plata mail service for a payment according to the weight of letters, etc., conveyed.

The early ships of this line were the finest class of paddle-wheel steamers built of wood then afloat, or that had been sent to sea either for naval or mercantile purposes. Thus the "Forth," one of the original fleet, was somewhere about nineteen hundred tons gross or builder's measurement, eleven hundred and forty-seven tons register, and four hundred and fifty nominal horse-power. She was built at Leith in 1841. As government reserved the right of purchasing any of these ships at a valuation, she was, like the others, constructed in accordance with a specification from the Admiralty, under the survey and immediate control of officers appointed for the purpose. Ill luck, however, attended the early days of the company, for though the course of the vessels was a comparatively safe one, they lost six of their ships in the first eight years. The "Isis" sunk off Bermuda October 8, 1842, having previously struck on a reef. The "Galway" was lost April 15, 1843, twenty miles west of Corunna, when her captain, surgeon, various passengers, and a portion of her crew, consisting in all of sixty persons, perished. The "Medina" was wrecked on a coral reef near Turk's Island, May 12, 1844. The "Tweed," of eighteen hundred tons and four hundred and fifty horse-power, was lost February 12, 1847, on the Alicrane reef, off the coast of Yucatan, by which accident seventy-two of the one hundred and fifty-one persons which composed her crew and passengers were drowned. February 1, 1849, the "Forth" was lost on the same rocks which had caused the destruction of the

"Tweed," while the following year the "Actæon" was wrecked while rounding the point near Carthagena. Some of these disasters no doubt arose from the intricate character of the navigation among the West India islands, and others, as it was alleged, "by those sudden changes of weather—hurricanes, squalls, 'northers,' etc.—with which the West India Islands, Spanish Main, and Gulf of Mexico are so frequently visited." But as the company has met with much fewer disasters of late years, incompetency probably had something to do with these almost periodical losses. In November, 1852, the "Demerara," which had been launched the preceding September from the banks of the Severn, was stranded across the river, and so injured that she had to be broken up, and her engines utilized on the "Atoch," an iron paddle-wheel steamer, launched the following spring.[64] The "Demerara" was at the time of her launch the largest steamship save the "Great Britain" afloat. She was three hundred and sixteen feet long over all, two hundred and eighty-two feet between the perpendiculars, and two hundred and seventy-six feet keel, and was two thousand three hundred and eighteen tons by the old, and upwards of three thousand tons by the new, measurement.

But by far the greatest disaster which befell any of this company's ships was the destruction of the "Amazon" by fire; indeed, nothing could be more terrible than the loss of this ship and the sufferings of those who perished with her. The "Amazon" was built at Blackwell, and launched on the 28th of June, 1851. She was the largest wooden merchant steamship which up to that time had been constructed. She was three hundred and ten feet in length, forty-two feet in width, seventy-two feet over the paddle-boxes, and thirty-two feet in depth; she was about three thousand tons burden, or two thousand two hundred and fifty-six tons register, and was fitted with engines of eight hundred horse-power, the diameter of the cylinders being ninety-six inches each, and the stroke nine feet. The engines made fourteen revolutions of her wheels, which were forty-one feet in diameter, per minute, giving her a speed by log of eleven knots. Her cost was upwards of eighty thousand pounds, and when ready for sea somewhat over one hundred thousand pounds. When surveyed by the Admiralty before her departure from Southampton, she was reported capable of carrying fourteen 32-pounders and two ten-inch pivot guns of eighty-five hundred-weight each, and her coal-bunkers were constructed to carry one thousand tons of coal, sufficient for sixteen and one-half days' full steaming. On the 2d of January, 1852, the "Amazon" sailed from Southampton on her first outward voyage. On the 4th of January, when about one hundred and ten miles west-southwest of the Scilly Islands, the watch on deck discovered that a

[64] See *ante*.

fire had broken out suddenly on the starboard side forward, between the steam-chest and the galley, the flames at once rushing up the gangway in front of the foremost funnel. All efforts to check the progress of the fire proved futile, and the most terrible consternation and confusion prevailed, the gale which howled overhead and around them increasing the terror of the awful calamity. The boats were burnt where stowed or swamped when lowered, save two of the life-boats and a small dingy, in which sixty-five of the one hundred and sixty-one souls on board managed to escape from the burning wreck, ninety-six, including the captain, perishing in the ship.

These losses left the company only the "Orinoco," "Magdalene," and "Parana" for the direct service between Southampton and Colon, but stimulated rather than depressed by misfortune they chartered other vessels, and entered into the construction of steamers of a still finer description. When the government relieved them from the condition of building wooden vessels adapted for purposes of war, and the directors discovered that iron was preferable to wood, and the screw a better mode of propulsion than the paddle, they produced vessels equal to most of those engaged in transatlantic navigation.

There are not now many finer vessels afloat than the "Tagus" and "Moselle," launched in 1871, and the later ships of this line. The "Moselle," of about three thousand two hundred tons gross register and engines of six hundred horse-power, made 14.929 knots per hour as the average per four runs over the measured mile; and the "Tasmanian," an iron screw-vessel, also fitted in 1871 with compound engines, accomplished her first voyage to St. Thomas in fourteen days and two hours, on a consumption of only four hundred and sixty-six tons of coal, though before the alteration in her engines she had consumed ten hundred and eighty-eight tons in making the same voyage.

The fleet is now a fine one, consisting of twenty-four steamships of from three thousand four hundred and seventy-two tons registered tonnage down to one thousand, and nearly all iron screw-vessels.

OCEAN STEAMSHIPS, 1875.

	Tonnage.		Horse-Power.
	Gross.	Net.	
The Cunard Line.			
25 Transatlantic	64,718	41,078	10,009
11 Mediterranean and Havre	16,215	10,580	2,126
8 Halifax and Bermuda Trade	2,384	1,618	892
3 Glasgow and Liverpool	2,372	1,431	560
6 Glasgow and Belfast	3,992	2,296	1,340
1 Glasgow and Londonderry	691	331	150
49 Vessels	90,372	56,329	14,577

	Tonnage.		Horse-Power.
	Gross.	Net.	
Inman Line.			
16 Vessels Transatlantic Fleet	43,955	29,398	6,760
Allan Line.			
23 Vessels Transatlantic Fleet	54,619	33,317	8,350
Anchor Line.			
31 Vessels	71,328	47,474	15,417
White Star Line.			
6 Vessels	25,198	.....	4,020
Guion Line.			
.....	.....	.....	.....
National Line.			
8 Vessels	25,342	.....	2,700
Bremen Line.			
.....	.....	.....	.....
Hamburg Line.			
.....	.....	.....	.....
Royal West India Mail Line.			
24 Vessels	53,806	.....	9,350
Liverpool, Brazil, and River La Plata Steam Navigation Company.			
31 Vessels	32,995	49,294	.....
Peninsular and Oriental Steam Navigation Company.			
35 Vessels Mediterranean, Adriatic, India, and China Service	.....	.....	.....
8 Australian Service	.....	.....	.....
5 China and Japan Local	.....	.....	.....
5 Cargo-Vessels	.....	.....	.....
5 Refitting	122,030	.....	22,095
18 Steam-Tugs	1,240	.....	460
8 Cargo- and Coal-Hulks	4,417	.....	.....
67 Vessels	.....	.....	.....
Fleet of the Messageries Maritime Company.			
18 Screw-Vessels India, China, Japan, Batavia, and Mauritius Line	43,088	.....	7,750
6 Screw-Vessels River La Plata and Brazil Lines	17,304	.....	3,100
29 Screw-Steamers, Mediterranean, and 6 Paddle " Black Sea Line	44,113	.....	10,320
3 London and Marseilles Line	4,476	.....	750[1]
4 Building, Screw	16,000	.....	2,400
64 Vessels	.....	.....	.....
Total	124,976	.....	24,320
Anchor Line.			
8 Vessels Transatlantic Service	29,790	.....	.....
18 " Mediterranean "	26,428	.....	.....

[1] Compound.

Pacific Steam Navigation Company.—54 vessels of 119,870 aggregate tons, and 21,895 horse-power; 22 of these vessels, ranging from 2856 to 4671 gross tons, were on the line between Liverpool, through the Straits of Magellan, to Valparaiso and Callao, Peru.

The remaining 32 vessels, 323 to 1915, and averaging about 1500 tons each, were employed on the west coast of South America. This line originated in the enterprise of Mr. Wheelright, an American resident of Valparaiso.

1850.—The Collins Line.—In 1847, Mr. Edward K. Collins with others, emulous of the success which had attended the Cunard Line, contracted with the government of the United States to convey the United States mails between New York and Liverpool, agreeing to

make twenty voyages in each year, and to employ five first-class vessels in doing so. For the fulfillment of this agreement the Collins Company was to receive nineteen thousand two hundred and fifty dollars per voyage. The company was unable to get the vessels ready within the stipulated time, and the time for their completion was extended. It was also favored with an advance of twenty-five thousand dollars a month on each vessel from the date of its launch until the sum should amount to three hundred and eighty-five thousand dollars. It was also agreed on the part of the government that the company should not be compelled to complete its fifth vessel. Then, in consideration of the company's making twenty-six instead of twenty annual voyages, the subsidy was increased from nineteen thousand two hundred and fifty to thirty-three thousand dollars per voyage, or to eight hundred and seventy-eight thousand dollars yearly. For these pecuniary considerations the company was urged by the United States government, and endeavored as well as agreed, to make the fastest passages between England and America. This endeavor was made with great spirit, and statements submitted to Congress show that it cost nearly half a million of dollars annually to effect the saving of a single day or a day and a half on the passage to Liverpool. Notwithstanding the large subsidy, the Collins enterprise, after sustaining the loss of two out of four of the company's ships, completely failed.

Of the Collins fleet, the ships of which were in their day the finest afloat, both as to accommodations and speed, the "Arctic" was run into by a French vessel in mid-ocean and sunk; the "Pacific," with all on board, including the wife of Mr. Collins, was never heard from after sailing from Liverpool; the "Atlantic" was broken up in New York in 1879. On her arrival at Liverpool in 1850 she was found to be too large for any of the docks, so that she of necessity lay out in the river.

The principal dimensions of the "Atlantic" were: length between the perpendiculars, 276 feet; beam, 45 feet; and across the paddles, 75 feet; depth of hold, 31 feet 7 inches; diameter of wheel, 36 feet; tons burden, 2860, and she was stated to be the largest steamship ever built. The "Pacific" was a sister-vessel. The "Adriatic," the queen of the fleet, is used in the Western Islands as a coal hulk by an English steamship company.

This leaves only the "Baltic" to be accounted for, a vessel which cost seven hundred thousand dollars. It is claimed that she made the quickest trip under steam alone that had ever been made in crossing the Atlantic. It must be remembered that the White Star steamships, which have made such rapid passages, spread nearly an acre of canvas, while the "Baltic" had comparatively no canvas. After the failure of the Collins Line, the "Baltic" was altered into a sailing-ship, and made several trips from San Francisco to Europe with wheat, her freight sometimes amounting to more than seventy thousand dollars. Afterwards she

was sold to a German company, who hoped to sell her to Russia during the Turkish war, but the war ceasing, she was sold to her present owners, and in coming from Bremen to Boston met with a terrific gale, which strained her so badly that it was determined to break her up for the old material in her. Soon, said a Boston paper of October, 1880, all that will be left of the "Baltic" will be a collection of old junk and a smoking hulk at Apple Island, the graveyard of many a fine vessel. So ends the last of the old Collins Line, all of which were paddle-wheel steamships, excepting the "Adriatic," which never made a trip on the line.

The "Arctic," the fastest steamer of the line, was modeled by George Steers, who designed the yacht "America"; her tonnage was 2856 tons; length of deck, 282 feet; breadth, 45 feet; and depth below main deck, 24 feet. Her cylinders were 95 inches diameter, stroke 10 feet. On her eighth passage from New York to Liverpool she made the then extraordinary time of 9 days 17 hours and 12 minutes. Her paddle-wheels were 35 feet 6 inches diameter, and contained each 36 floats. She burned about 87 tons of coal a day.[65]

From the start the Collins Company seems to have suffered from want of capital. Although the four vessels of this company cost two million nine hundred and forty-four thousand one hundred and forty-two dollars, its paid-in capital only amounted to one million two hundred thousand dollars. It began, therefore, with a debt of one million seven hundred and forty-four thousand one hundred and twenty-two dollars, which made a continual drain for interest and commissions.

[65] Sir Edmund Cunard testified, in 1860, that the Collins Line got at first for twenty-four voyages four hundred and one thousand and forty dollars from our government, and that it afterwards received eight hundred and ninety-three thousand seven hundred and fifty dollars for twenty-six voyages, or double his own subsidy, considering that he made two voyages to one. The capital of the Collins Line, three million five hundred thousand dollars, he said, would have been entirely sunk but for the loss of two ships, by which they got one million two hundred and fifty thousand dollars from the English underwriters.

He said if his contract was withdrawn he had better sink his ships than try to keep them, for they were not adapted for mercantile uses at all. The "Scotia" cost him nine hundred thousand dollars. Cunard's original subsidy, for twenty-four voyages a year, was three hundred thousand dollars per annum for seven years. In 1852 he agreed to make a weekly service for eight hundred and sixty-five thousand dollars a year, to last ten years; five years afterward he demanded a larger extension of the contract, so he could borrow money to build faster steamers than Collins. Collins' original four steamers cost two million nine hundred and ninety-four thousand dollars, and his last experiment, the "Adriatic," ruined him. The average cost of each of his early voyages was sixty-five thousand two hundred and fifteen dollars, and the corresponding receipts forty-eight thousand two hundred and eighty-seven dollars, yet he carried more passengers from the beginning to the end than the Cunarders.

Mr. Collins' first proposition to the government of the United States was made in 1845, but no contract was concluded until 1847. The "Atlantic" was the first to take her departure for Europe in April, 1850, the "Pacific" followed in a few weeks, then the "Arctic" and the "Baltic" soon after; these vessels were almost alike in model and in dimensions.

With careful management this difficulty might have been overcome, for its receipts from the government for the transportation of mails during the first five years amounted to more than the cost of the vessels. Its receipts from other sources were large, and when the "Arctic" and "Pacific" were lost they were insured for their value at the time. Mr. Collins submitted to Congress the following statement, dated February 17, 1855:

Total receipts for passengers and freight	$4,460,867
" " mail service	3,413,966
	$7,874,833
Total disbursement	7,207,291
Leaving a nominal surplus of	$667,542

which was more than disposed of, as follows:

Loss of the "Arctic"	$255,000
Depreciation of investment	258,000
7 per cent. interest on capital	408,000
	$921,000

The all-controlling desire which seemed to outweigh every consideration of prudence was principally in relation to speed. Mr. Olds, of Ohio, in the United States House of Representatives, expressed the feeling of multitudes in the country when he said, "We have the fastest horses, the prettiest women, and the best shooting-guns in the world, and we must also have the fastest steamers. The Collins Line must beat the British steamers. Our people expect this of Mr. Collins, and he has not disappointed them."

THE GREAT OCEAN STEAMSHIP COMPANIES.—Cunard, 1840; Royal West India Mail, 1841; Peninsular and Oriental, 1840; Pacific Steam Navigation, 1840; Collins, 1847; Pacific Mail Steamship Company, 1848; Warren, 1850; Inman, 1850; The Messageries Maritimes, 1851; Allan, 1854; Anchor, 1856; North German, 1857; Leyland; Compagnie Générale Transatlantique, 1862; Williams & Guion, 1866; White Star, 1870; American or Keystone, 1871; City Line.

THE CUNARD LINE, 1840.—Mr. Samuel Cunard was one of the first to foresee the great results that might be achieved by the establishment of steamer communication between the United States and England, and as far back as the year 1830, in his quiet home in Nova Scotia, was thinking over the best means of carrying out this project. In 1838, Mr. Cunard came to England, bent upon putting his idea into operation, and, introduced by Sir James Melvill, of the India House, he presented himself to Mr. Robert Napier, the eminent marine engineer, and the result of their deliberations was that Mr. Cunard gave Mr. Napier an order to make four steamships for the Atlantic service. The four vessels were to be of nine hundred tons each, and three hundred horse-power. Mr. Napier advised the building of larger vessels,

and ultimately it was arranged that the four vessels should each be of twelve hundred tons burthen and four hundred and forty horse-power.

The project now assumed a proportion beyond the resources of a private individual, and Messrs. Cunard and Napier, taking counsel together, hit upon the idea of forming a company. Messrs. Burns, of Glasgow, and Messrs. MacIver, of Liverpool, after having run coasting steamers in keen rivalry for several years, in 1830 amalgamated their undertakings, and this firm of Burns & MacIver was, at the time that Mr. Cunard came to England, one of the most prosperous shipping companies in Great Britain. The proposal to form an Atlantic steamship company was mooted to Messrs. Burns & MacIver by Mr. Napier, and the outcome was the establishment, in 1839, of the "British and North American Royal Mail Steam Packet Company." This official title being rather lengthy for hurried utterance, a convenient substitute was found in the simple phrase, "Cunard Line." This phrase has now become familiar as a nautical term from Sandy Hook to the Suez Canal, and from Scotland to the West Indies. Samuel Cunard may be justly regarded as the father of the line, and his enterprising partners, the MacIvers and Burnses, have shown themselves to be quite adequate to the grave responsibilities which they then assumed. About this time the government decided, on grounds of public convenience, as well as with the view of promoting the extension of steam navigation, to abandon the curious old brigs which had been used for so many years for the conveyance of the mails across the Atlantic and to substitute steam mail-boats. The admiralty accordingly advertised for tenders for this service, and the Great Western Steam Shipping Company and the newly formed company of Messrs. Cunard, Burns & MacIver were the only competitors. The tender of the latter firm was accepted, and a seven-years' contract was entered into between the lords of the admiralty on the one part, and Samuel Cunard, George Burns, and David MacIver on the other part, for the conveyance of mails fortnightly between Liverpool and Halifax, Boston, and Quebec, in consideration of the annual sum of £60,000. One of the conditions of the bargain was that the ships engaged in this service should be of sufficient strength and capacity to be used as troop-ships in case of necessity. The first four ships built under Mr. Napier's direction for the Cunard Company were the "Britannia," the "Acadia," the "Caledonia," and the "Columbia." The "Unicorn" was dispatched from Liverpool on the 16th of May, 1840, to be placed on the branch route to Newfoundland, and she made the passage to Boston in nineteen days.

There was considerable excitement in Boston on the afternoon of Tuesday, June 2, 1840, when it was announced that Mr. Cunard's steamship "Unicorn," Captain Douglas, was entering the harbor. The arrival of the first regular steam packet from Europe had been

looked forward to with interest, as marking a most important epoch in the commercial relations of the New World and the Old. The people, young and old, men, women, and children, assembled as the "Unicorn" approached Long Wharf, and the scene on water and land was inspiring and enthusiastic. Cheers rent the air, handkerchiefs and hats were waved. As the "Unicorn" approached, the United States ship-of-the-line "Columbus," moored in the channel, hoisted the English ensign at the fore, and her band played the national tunes of England and the United States, and the revenue cutter "Hamilton," which made a gallant appearance dressed in flags and bunting, fired a salute. For a short time the "Unicorn" "lay to" off the wharf, and as Captain Sturgis, commanding the "Hamilton," stepped on board and tendered a welcome to Captain Douglas, a round of cheers went up from the crowd. Then the "Unicorn" steamed along the water-front and wharves to the vicinity of the navy-yard, and proceeded to the Cunard wharf at East Boston, which had been recently built, and at that time was considered elegant and spacious in every respect. As she passed the revenue cutter she was again saluted, and returned the salute. Salutes were also fired from the wharf. On two lofty flagstaffs erected on the extremity of the wharf British and American ensigns were hoisted. When moored at the wharf many people hastened on board to exchange congratulations with the captain, officers, and passengers.

The "Unicorn" encountered a good deal of rough weather on her voyage, but proved a good and stanch boat. Her machinery worked well, and the passengers were well pleased with their accommodations. She brought out twenty-seven cabin passengers to Halifax and twenty-four to Boston, and files of London papers to the 15th of May, of Liverpool papers to the 16th, and of Paris papers to the 13th.

The day following her arrival the Boston newspapers were full of copious extracts from the foreign papers which the "Unicorn" brought, and which were appended to the short notice of the important event. Regret was expressed that the political and commercial intelligence by the arrival was not more important, but the heading, "Sixteen Days Later from Europe!" clearly indicated that one of the most important advantages that was anticipated by the opening of steamship communication between Boston and Liverpool was the quicker exchange of news with the Old World.

The arrival of the "Unicorn" was the talk of the city, and the city felt called upon to take proper recognition of so significant an occurrence, and three days later, on Friday, June 5, the city authorities extended a welcome to Samuel Cunard, Jr., a son of Samuel Cunard, and Captain Douglas, commander of the "Unicorn," at Faneuil Hall. The cradle of liberty was beautifully festooned with the flags of the United States and Great Britain, and was otherwise decorated in a very tasteful manner. The city officials and invited guests marched in procession

to the hall from the old City Hall, where a banquet had been prepared for about four hundred and fifty persons. Hon. Jonathan Chapman, the mayor of Boston, acted as the presiding officer and master of ceremonies. In his address of welcome he enlarged upon the vast importance to Boston of steam navigation with Europe in connection with the western railroad. The sentiment which he offered in conclusion was, "Commercial enterprise—It waked up the dark ages; it launched mankind upon the sea of improvement; it guided the bark and spread the sail until a sail is no longer needed to join the two continents together." Mr. Cunard, Jr., was then called up, and made a pleasant response, and the band played "God save the Queen." Commander Douglas gave a brief account of the voyage, and said the steamers that were being built for the line were to be much larger, and he had reason to believe that the passage would be made in fifteen days. To a toast in honor of England and America, Hon. Mr. Grattan, her Britannic majesty's consul, responded, and then, the mayor calling for volunteer toasts, there followed the most sparkling wit and sentiment. Hon. Robert C. Winthrop, then Speaker of the House, made an eloquent speech, and, referring to the dictum of Dr. Dionysius Lardner, that steam navigation across the ocean was physically impossible, said that, to all appearances, it was quite as improbable as the scientific doctor's late elopement to France with Mrs. Heaviside. The poet Longfellow offered this beautiful sentiment: "Steamships—the pillar of fire by night, and the cloud by day, which guide the wanderer over the sea." The Chevalier de Friederichsthal, attached to the Austrian embassy at Washington, M. Gourand, from Paris, and other distinguished foreigners, John P. Bigelow, John C. Park, Hon. George S. Hillard, Nathaniel Greene, then postmaster of Boston, and others offered appropriate sentiments, and Governor Everett, who was not present, sent a letter.

The celebration was creditable to the city and the event it commemorated, but nevertheless evoked the criticism of censorious individuals, who evidently did not understand or agree with the old proverb, —that the way to a people's heart is through their stomach. In comparison with steamships which now enter Boston and New York, the "Unicorn" was small and insignificant, and yet the arrival of no craft was ever looked forward to with greater anticipation or more genuine pleasure.

With the arrival of the "Unicorn" began the steam traffic between Boston and London and Liverpool, which has since assumed such large proportions. Its coming marked a new era in civilization, and was the harbinger of an immense commercial traffic, and a wonderful rapidity of communication between the New World and the Old. Over forty years have elapsed and ocean steamers daily arrive, but they excite little interest now.

The "Unicorn" was followed, by a coincidence which was entirely unintentional, on the 4th of July from Liverpool by the "Britannia," under command of Lieutenant Woodruff, R.N., for Halifax and Boston, the first regular vessel of the Cunard Line. Liverpool was in a condition of great excitement on the day of the vessel's departure; thousands of people crowded the quays to watch her out, and it was felt that a new era of oceanic intercourse had been begun by this memorable event.

The "Britannia" entered Boston harbor after a run of fourteen days and eight hours. The ship came to her moorings on a Saturday evening, but the inhabitants of Boston thronged the wharves to welcome her, and salvos of artillery were fired in honor of the occasion. Mr. Cunard, Sr., accompanied the vessel, and so great was the enthusiasm created by his enterprise that he received eighteen hundred invitations to dinner within twenty-four hours after his arrival. On the 17th of August the "Acadia" arrived at Boston, after a passage of twelve days and eighteen hours; the shortest passage between the two continents which had been made. Three days later a public banquet was given in honor of the event, at which Hon. Josiah Quincy presided. For seven years these four steamers, reinforced by two others, carried out the contract with the government. At the end of that time the British government called upon the company to double the number of its sailings, and every new steamer was, in some respects, an improvement upon its predecessors.

Prior to 1852 the fleet of the Cunard Company consisted entirely of wooden steamships (paddle-wheels), but in that year the "Andes" and "Alps," both iron vessels *with screws*, were added to the long "catalogue of the ships." These were afterwards taken up by the British government for transport service in the Crimea, and were followed, in 1854 and 1855, by the "Jura" and the "Ætna," both iron screws, and both for the Atlantic trade. In 1856, with the "Persia," the experiment was tried of building an *iron* paddle steamer. The "Persia" was of three thousand three hundred tons burthen, and nine hundred horse-power. She was followed, in 1862, by the "Scotia," also built of iron, and of still larger dimensions. It soon became apparent not only that iron was the best material for ocean steamers, but also that the screw furnished the best means of propelling them, and in all the subsequent additions to the fleet these truths have been recognized and acted upon.

Between 1840 (when the Cunard Company, strictly so called, came into existence) and 1876, it had built one hundred and twenty-two steamers, and in that year owned a navy of forty-nine vessels, viz.: twenty-four in the Atlantic mail service, twelve in the Mediterranean and Havre Line, five plying between Glasgow and Belfast, three between Liverpool and Glasgow, three between Halifax and Bermuda,

and two between Glasgow and Derry. The money value of the Atlantic mail boats alone was estimated at between fifteen million and twenty million dollars, and it would not be an exaggeration to state that of the entire fleet was double the amount. According to an official statement made by the company about this time a Cunard transatlantic steamer had sailed at first once a week, subsequently twice a week, and latterly three times a week from Liverpool, and another from New York or Boston, making over four thousand voyages across the Atlantic, an aggregate distance of over twelve million miles, carrying more than two million of passengers without the loss of a life or even of a single letter.

The Fleet of the Cunard Line, 1881.

Aleppo.	Malta.[3]	Scythia.[1]
Atlas.[2]	Marathon.[3]	Servia.[1]
Batavia.[2]	Morocco.	Sidon.[3]
Bothnia.[1]	Olympus.	Tarifa.[3]
Catalonia.[1]	Palmyra.	Trinidad.
Demerara.[3]	Parthia.[1]	Aurania (building).
Gallia.[1]	Samaria.[2]	Cephalonia "
Kedar.[3]	Saragossa.	Pavonia "

The transatlantic steamers of this line sail every Wednesday and Saturday from New York and from Boston for Liverpool, and as often from Liverpool for each of those ports.

By a report of the directors of the lately formed Cunard Stock Company it is shown that the net profits of the year 1880 amounted to one hundred and ninety-three thousand eight hundred and eleven pounds.

The three steamers building are to be of steel. The "Aurania" will be seven thousand tons, and have engines of eight thousand five hundred horse-power; and the "Pavonia" and "Cephalonia," each of five thousand tons and four thousand five hundred. The "Servia," the latest addition to the Cunard line, arrived at New York at 11 A.M., December 8, 1881. She left Queenstown at 10 A.M., November 28, and, taking into consideration the boisterous weather she encountered, the passage was a remarkably quick one. Her purser, Mr. William Field, said that he never experienced such a rough time, though he has held his present position for twenty-five years, having served in every ship on the line, and made over four hundred passages. No damage whatever occurred to the big craft.

The "Servia" brought one hundred and seventy-one cabin passengers and one hundred and fifty-five in the steerage. In point of size

[1] Between New York and Liverpool. [2] Between Boston and Liverpool.
[3] Mediterranean service.

the "Servia" is only exceeded by the "Great Eastern," while as regards engine-power, it is claimed that she surpasses anything afloat.

Mr. John Burns, of the Cunard Company, in a communication to the London *Times* when the "Servia" was on the stocks, said, concerning her,—

"This vessel has been designed, after lengthened consideration, to meet the requirements of our traditional service, and we have adopted in every detail of the ship and engines the most advanced scientific improvements compatible with the safe working of so great a vessel. Among the important matters into which we have crucially inquired has been that of the employment of steel instead of iron, and after a practical and thorough examination into the merits of both materials we have adopted steel for the hull and boilers, but under a provision so stringent that every plate, before acceptance, will undergo a severe and rigid test by a qualified surveyor appointed and stationed at the steel manufactory for that special purpose, and that the manipulation of the steel by the builders shall be subject to an equally careful supervision by qualified engineers of our own appointment. The steel is to be made on the Siemens-Martin process, and all rivets as well as plates throughout the ship are to be of steel."

The substitution of steel for iron has not only improved the steamship, steel being more ductile and stronger than iron, but it has a great advantage economically. The "Servia" weighs six hundred and twenty tons less than she would have done if she had been built equally strong with iron; and of course she has so much greater carrying capacity.

The "Servia's" dimensions are: Length, five hundred and thirty-three feet; breadth, fifty-two feet; depth, forty-four feet nine inches; gross tonnage, eight thousand five hundred tons. A better idea, perhaps, of the vast size of the vessel may be gathered from the following facts: Her cargo capacity is six thousand five hundred tons, with eighteen hundred tons of coal and one thousand tons of water ballast, the vessel having a double bottom, on the longitudinal bracket system. The anchor davits are eight inches and the chain-cable pipe twenty-two inches in diameter. The propeller-shaft weighs twenty-six and one-half tons, and the propeller, boss, and blades are thirty-eight tons in weight. The machinery consists of three cylinder compound surface condensing engines, one cylinder being seventy-two inches and two one hundred inches in diameter, with a stroke of piston of six feet six inches. It is anticipated that the indicated horse-power will amount to ten thousand five hundred. There are in all seven boilers, six of which are double- and one single-ended, and all are made of steel with corrugated furnaces, the total number of furnaces being thirty-nine.

Practically the "Servia" is a five-decker, as she is built with four decks and a promenade. The promenade, which is reserved for the passengers, is very large and spacious. On the forepart of it are the

steam steering-gear and house, the captain's room, and flying bridge. On the upper deck forward is the forecastle, with accommodations for the crew, and lavatories and bath-rooms for steerage passengers, while aft are the light-towers for signaling the admiralty lights, with the lookout bridge on the top. Near the midship-house are the captain's and officers' sleeping-cabins. Next to the engine skylight is the smoking-room, which can be entered from the deck or from the cabins below. It is unusually large for a smoking-room, being thirty feet long by twenty-two feet wide. Near the after-deck house is the ladies' drawing-room, to which access can be obtained either from the music-room or from the deck. Abaft of this, and in the upper end of the upper deck, is the music-room, which is fifty feet by twenty-two feet in dimensions, and which is fitted up in a handsome manner, with polished wood panelings. Immediately abaft of the music-room is the grand staircase leading to the main saloon and the cabins below on the main and lower decks. At the foot of the stair leading to the saloon, and also in the cabins, the panelings are of Hungarian ash and maple wood. The saloon is very large, being seventy-four feet long by forty-nine feet wide, with sitting accommodation for three hundred and fifty persons, while the clear height under the beams is eight feet six inches. The sides are all in fancy wood, with beautifully polished inlaid panels. All the upholstery of the saloon is of morocco leather. Right forward of the after-deck are the baths, lavatories, and state-rooms. The total number of state-rooms is one hundred and sixty-eight, and the vessel has accommodation for four hundred and fifty first-class and six hundred steerage passengers, besides a crew of two hundred officers and men. For two-thirds of its entire length the lower deck is fitted up with first-class state-rooms. The ship is divided into nine water-tight bulkheads. There are in all twelve boats equipped as life-boats.

The arrangement of the water-tight doors in the engine- and boiler-spaces is admirable, as in case of accident they can be shut from the upper deck in two seconds or so. The keel is built in five layers, having a total thickness of six and three-quarter inches. The upper deck, which is of steel, has a covering of yellow pine; the main deck, which is also of steel, is covered with teak, and the lower deck, again of steel, is shielded with teak above the engine- and boiler-spaces. The deck-houses and deck-fittings, which in unusually heavy weather might otherwise be liable to be carried away, are made of iron and steel, and are riveted to the decks underneath. The "Servia" is built with a double bottom, so that in the event of her running on the rocks and having a hole knocked in her hull, she would still be perfectly safe as long as the inner skin remained intact. She has three masts of the special Cunard rig, and they carry a good spread of canvas to assist in propelling her. She is fitted with steam steering-gear, steam winches, and a second steering-gear, independent of the steam apparatus. The

latest scientific improvements have been adopted in all parts of the vessel; steam is used for warming the cabins and saloons, and every passage has its own series of ventilators.

On her trial trip she repeatedly attained a speed of twenty and one-half miles an hour. This is equivalent to about eighteen knots. During the trial she carried two thousand five hundred tons of dead weight aboard.

In former days it was held that the ratio of indicated horse-power in the engines to the tons burden of the vessel should be as one to four. In the "Great Eastern," with her propeller and paddle-wheels, the ratio was as one to fourteen. But in the "Servia" and other new boats the number of indicated horse-power is greater than the number of tons burden. The engines are exceedingly powerful, even when the size of the vessel is considered; and hence the framework of the hull has to be made with great rigidity and with the utmost care. The increase in speed attained by these changes can only be demonstrated by experience; but it seems to be the opinion of many nautical men that, with such heavy engines, the jar given to the hull will make the "Servia" and vessels of her class less comfortable as passenger crafts than some of the older and smaller transatlantic steamers.

The business of the Cunard Company in its various branches has, from its origin, been carried on in Glasgow by G. & J. Burns; in Liverpool, by D. & C. MacIver; in Halifax, by S. Cunard & Co.; and in New York, by Sir Edward Cunard, Bart. Mr. David MacIver died a few years after the formation of the line. Sir Samuel and his son, Sir Edward, died later. George and James Burns retired from business in favor of two sons of the former, John and James Cleland.

Mr. William Cunard, one of the managing directors of the company in 1881, is the second son of Sir Samuel Cunard, who founded the company, and was created a baronet by the Queen for his enterprise in transatlantic steam navigation. For many years the Cunard Company received a subsidy of one hundred and seventy-six thousand three hundred and forty pounds per annum under its mail contracts, but for some years past the only compensation the line has received for carrying the mails has been one-third of the actual postage paid. The steamships of the company are, however, as formerly, inspected on the day before sailing from England by officers of the Board of Trade. When first established they carried an officer of the royal navy as mail agent, but that practice has been discontinued.

It is remarkable to note the extraordinary progress achieved since the "Britannia" made her first voyage in 1840. Though measuring eleven hundred and thirty-nine tons, she had capacity for only two hundred and twenty-five tons of cargo, whereas the "Bothnia," of four thousand three hundred and thirty-five tons, built in 1874, takes three thousand tons of cargo, or nearly fourteen times as much, though only

four times larger. The "Britannia" carried ninety passengers, whereas the "Bothnia" carries three hundred and forty, or close upon four times as many. The former steamed eight and a half knots, the latter steams thirteen knots an hour, or more than half as quick again, or less than half the coal per indicated horse-power per hour, and as about the same quantity of fuel for the actual number of miles run. The "Persia," in her day the finest vessel afloat, took six tons of coal to carry a ton of freight across the Atlantic. The "Arizona," about double the size of the "Persia," takes a fifth of a ton.

The "Gallia's" model received a first-prize gold medal at the Paris Exhibition. She was barque-rigged, and built after the general design of the "Scythia" and "Bothnia," but she is longer and wider than either. Her length is four hundred and fifty feet over all, her moulded width forty-four feet, and her depth of hold thirty-six feet, with a measurement capacity of four thousand eight hundred and nine tons. Her machinery includes the latest improvements. She has three compound direct-acting cylinder engines, two of them being eighty-four inches in diameter, and the third sixty-one inches; the piston-stroke being sixty inches, affording a nominal force of seven hundred horse-power, which, however, can be increased, should necessity demand, to over three thousand horse-power. She has state-room accommodations for four hundred and eighty first-class passengers, and has equally large accommodation for steerage passengers. The cabin fittings and arrangements, and the state-rooms, are unusually fine. The principal dining-saloon is on the spar deck, and is lighted by a series of top and side lights. It is floored with oak parquetry of Belgian manufacture, and the walls are inlaid with Japanese paneling upon a ground of red jasper, with gold tracery. There are sideboards and mirrors, a piano, and a large library. The second dining-saloon (on the main deck) is furnished with taste, and both have revolving sofa chairs at the tables. On the upper deck there is a "ladies' boudoir," and a "ladies' cabin" on the spar deck, the latter being paneled with Brazilian onyx and richly upholstered in blue. A commodious and beautifully-fitted smoking-room for gentlemen is on the main deck. The state-rooms and berths are large, well ventilated, and fitted with many improvements, including stationary wash-basins and steam-heaters of new pattern. They all communicate by means of pneumatic bells in the steward's department. The vessel carries a crew of one hundred and thirty men.

PACIFIC MAIL STEAMSHIP COMPANY, 1848.—This company was compelled at the outset to form an establishment of the most effective character four or five thousand miles away from home, and it was at that time thirteen thousand miles distant. The country was wholly new, so much so that it was, in most parts of the field which it had to occupy, extremely difficult to procure ordinary food for their operations. Their ships had to make a voyage more than half of that around the

world before they arrived at their points of service, and they found themselves without a home when there. The steamer "California," 1086 tons, which left New York on the 6th of October, 1848, was the first of the line to bear the American flag to the Pacific Ocean, and the first to salute with a new life the solitudes of that rich and untrodden territory. She was soon followed by the "Panama," 1088 tons, and "Oregon," 1099 tons, and in due course by the "Tennessee," the "Golden Gate," 2068 tons, the "Columbia," 778 tons, the "John L. Stephens," 2189 tons, the "Sonora," 1614 tons, the "Republic," 850 tons, the "Northerner," 1010 tons, the "Fremont," 576 tons, the "Tobago," 189 tons, the "St. Louis," 1621 tons, and the "Golden Age," 2280 tons.

These steamers found nothing ready to receive them in the Pacific. The company was compelled to construct large workshops and foundries for their repair, and now have at Benicia a large and excellent establishment, where they can easily construct a marine engine. They had also to build their own dry-dock. They had also to make shore establishments at Panama, San Francisco, and Astoria, which, with coal depots, etc., were extremely costly, owing to materials having to be transported so far and labor at the time being so high owing to the rush to the gold-diggings. For a portion of the time the company had to pay thirty dollars a ton for coal, and in one instance fifty dollars. The success of building up this large establishment in the Pacific was simply an accident, and that accident the discovery of gold.

It is impossible in these notes to give even a brief sketch of all the fortunes and misfortunes of this great steamship company, but it is sufficient to say it still lives. All the early steamers were wooden paddle-wheelers, but, as in the case of all the ocean steamship companies, the fleet is now composed of iron screw ships. In 1876 it had a fleet of thirty-three steamers of an aggregate capacity of seventy-four thousand tons of cargo, exclusive of the large space assigned to passengers; but that fleet has since been very much reduced. It had then thirty-five chief agencies, and its steamers called at forty-seven ports in the Pacific and those in the Atlantic.

The China and Japan line was not started until the 1st of January, 1867, when the first of its fleet passed out of the Golden Gate of California bound across the Pacific to those ancient nations. The "Great Republic," "China," "Japan," and "America," all of them wooden vessels with paddle-wheels and walking-beam engines, soon followed. These vessels of about four thousand tons each made the voyage from San Francisco to Yokohama in twenty-two days, thence to Hong-Kong in seven days, the whole distance, including the stoppage at Yokohama, occupying thirty days.

In 1874 the company added to the line the "City of Tokio" and "City of Peking," two magnificent iron screw steamships of five thou-

sand five hundred and sixty tons burden, four hundred and twenty-three feet in length, forty-eight feet wide, and thirty-eight feet deep, being the largest steamships that had ever carried the American flag. They have since started a line of steamers to Australia and the Hawaian Islands.

The following table gives the name, class, tonnage, and passenger capacity of the present fleet of the company, but does not give the connecting lines in the Atlantic and South Pacific:

FLEET OF PACIFIC MAIL STEAMSHIP COMPANY.

Vessels.	Class.	Tonnage.	Passengers.	
			Cabin.	Steerage.
City of Peking	Iron screw.	5500	150	1500
" Tokio	"	5500	150	1500
" Panama	"	1490	55	150
" Sydney	"	3400	150	500
" New York	"	3400	150	600
" Rio Janeiro	"	3500	.....	.....
" Para	"	3500	.....	.....
Colon	"	2714	190	800
Colima	"	2906	190	800
Acapulco	"	2572	190	800
Granada	"	2572	190	800
South Carolina	"	2100	80	200
Crescent City	"	2016	80	200
Clyde	"	2028	100	200
Costa Rica	"	1457	120	600
Honduras	"	1428	60	250
Salvador	"	1050	50	100
Wilmington	.....	.....	.....	.....
Winchester	.....	.....	.....	.....
China	Wood S. W.	4300	156	1200
Alaska	"	4180	130	1000

Steamships of the line sail from New York on the 10th, 20th, and 30th of each month, and from San Francisco on the 4th and 19th of each month *via* the Isthmus of Panama.

The voyage between New York and San Francisco occupies twenty-five days: nine days between New York and Aspinwall; one day in crossing the Isthmus, including the transfer by steam-tug to or from steamers in the Bay of Panama; and fifteen days on the Pacific Ocean. Steamers call at no California port except San Francisco, and at no port between New York and Aspinwall. Connections are made at Aspinwall with Royal Mail, West India and Pacific, Transatlantique, and Hamburg-American steamers for ports on the Atlantic coast of Central, South, and North America, and the West India Islands.

At Panama, with Pacific Steam Navigation Company, for all Pacific ports of South America and Australia.

At Yokohama, with Mitsu Bishi Mail Line, for Japanese ports and Shanghai.

At Hong-Kong, with Peninsular and Oriental, Messageries Maritimes, Jardine, Matheson & Co., and Douglas, Lapraik & Co.'s steamship lines for all China, India, and Eastern ports, and *via* Suez Canal for all European ports. Also with steamers for Manilla and Batavia.

At Auckland, with Union Steamship Company, for all New Zealand ports.

At Sydney, with Australian Steam Navigation Company, for Australian ports; with Union Steamship Company, for all New Zealand ports; with Eastern and Australian Steamship Company, for Keppel Bay, Bowen, Townsville, Somerset, and *via* Torres Straits for Batavia, Singapore, and Calcutta; with Peninsular and Oriental steamers, for Melbourne, Adelaide, King George's Sound, Ceylon, etc., also with steamers for New Caledonia and Hobart Town; with Tasmanian Steam Navigation Company, for Hobart Town and Launceton.

THE WARREN LINE OF STEAMSHIPS BETWEEN BOSTON AND LIVERPOOL, 1850–1881.—The nucleus of this line was the once celebrated sailing-packets of Enoch Train & Co., viz.: the "Plymouth Rock," "Washington Irving," "Daniel Webster," "Anglo-American," "Anglo-Saxon," etc., ships of from one thousand to fifteen hundred tons; supplemented as the requirements of speed were called for by the clippers "Star of Empire," "Chatsworth," Staffordshire," "Cathedral," and the "Chariot of Fame," of from fifteen hundred to two thousand tons.

This line was solely a Boston enterprise for the carrying of freight and passengers between Boston and Liverpool. At times each ship brought from four hundred to eight hundred emigrant passengers, and the pressure was so great other ships had to be chartered.

Between 1850 and 1860 steam worked its way into the Atlantic carrying trade, and the Warren Company was among the first to substitute steam for sailing ships. The first vessels put upon this line were the "Propontis," "Bosphorus," "Delaware," "Meletia," "Peruvian," etc., bringing large cargoes, and on an average seven hundred passengers (emigrants). Return cargoes were then sought for in other ports.

In 1872 the trade had increased so much as to warrant the placing of large steamships on the line, such as the "Minnesota," "Victoria," and "Palestine," carrying from two thousand two hundred to two thousand eight hundred tons of merchandise. The "Iowa," of this line, has the capacity of carrying three thousand three hundred tons of merchandise, exclusive of coal, and makes an average passage of ten and one-half days between Boston and Liverpool. The other ships of this line (1881) are the "Canopus," "Milanese," "Pharos," "Glamorgan," and "Pembroke," to which have been recently added the "Missouri," of four thousand three hundred tons, and "Kansas," of four thousand five hundred tons dead-weight capacity.

In 1880 there was dispatched from Boston in eighty-four steamers

of this line twenty thousand and thirty-one tons of merchandise, twenty-eight thousand one hundred and seventy-six oxen, eleven thousand three hundred and twenty-three swine, and eighteen thousand and fifty-three sheep.

The "Missouri," in command of Captain A. H. Burwell, arrived at Boston Friday, June 10, having sailed from Liverpool on the 29th of May, thus making her first ocean voyage in about twelve days. She was built on the Clyde expressly for the Warren Line, and is pronounced one of the finest of the Atlantic steamers. Her dimensions are: length, four hundred and twenty-five feet; breadth, forty-three feet six inches; depth, thirty-five feet six inches, and the tonnage under deck five thousand. Her engines are three hundred horse-power, constructed on the compound principle, which are supplied with steam from four steel boilers at a working pressure of eighty pounds to the square inch. The steamer is fitted with four decks, three of which are iron, throughout the entire length, and sheathed with wood planking. She is divided into eight water-tight compartments, and has water-ballast capacity to the extent of seven hundred tons, and her dead-weight cargo and coal capacity will be five thousand tons. The steam steering-gear can be worked from aft, or in the pilot-house or on the bridge amidships.

THE MESSAGERIES MARITIMES, 1851.—Much the largest maritime undertaking engaged in the trade of the Mediterranean and elsewhere is that of the Messageries Maritimes, formerly the Messageries Imperiales, monopolizing as it does nearly the whole of the steam tonnage of France. Indeed, apart from the vessels owned by this company, and one or two highly subsidized, the French may be said to have no steamers. In 1873 the whole steam tonnage of France amounted to one hundred and eighty-five thousand one hundred and sixty-five tons net register, and in 1875 the gross tonnage of the fleet of Messageries Maritimes was one hundred and twenty-four thousand nine hundred and seventy-six tons. The Messageries Maritimes is a pure creation of the government, raised with the greatest care from its infancy, and maintained by large grants from the public purse. Previously to 1851 the company had been chiefly engaged as carriers by land, and was under contract for the conveyance of the mails throughout a considerable portion of France. In July, 1851, the company entered upon its first over-sea contract for the conveyance of the French mails to Italy, the Levant, Greece, Egypt, and Syria, and in 1852 added to their service the principal ports of Greece and Salonica.

In 1854 the managers contracted for the transport of all troops and military stores between France and Algeria, besides the conveyance of the mails, and having increased their fleet to meet the requirements of the Crimean campaign, were in 1855 enabled to open between Marseilles, Civita Vecchia, and Naples a direct weekly line of steamers, independently of the postal service. After the close of the

Crimean war in 1856, the directors employed their disposable vessels in increasing the frequency of services to Algeria, and in establishing a postal service between Marseilles and the ports of the Danube and along the east coast of the Black Sea. In 1857 they entered into arrangements for the conveyance of the French mails between Bordeaux, the Brazils, and the La Plata. At that time the fleet of the company had reached fifty-four ships of eighty thousand eight hundred and seventy-five tons and fifteen thousand two hundred and forty horse-power, and they obtained from their government in 1861 a contract for the conveyance of the French mails to India and China. In 1871 their fleet, measuring one hundred and thirty-seven thousand three hundred and thirty-four tons, of twenty thousand eight hundred and eighty-five horse-power, performed service on the India and China routes of two hundred and thirty thousand one hundred and thirty-five French leagues; on the Mediterranean and Black Sea, one hundred and fifty-three thousand four hundred and seventy-eight; and on the Brazilian, fifty thousand and four. In all four hundred and twenty-three thousand six hundred and seven leagues annually, independently of various extra services. Since then their Brazilian and La Plata lines have been doubled. At the first their vessels were built in England, but the company now possesses large establishments of its own, where they construct screw steamers of iron of the largest size. The ships of the Messageries Maritimes, like those of their great competitors for the trade of the East, the "Peninsular and Oriental Company," now pass through the Suez Canal.[66]

THE INMAN LINE, 1850–1881.—The history of the Inman Line, which owes its inception to William Inman (who died in 1881) and his co-partners, is the history of all the great institutions in England,—a good basis, sure foundations, and the gradual growth of a legitimate plan. It was the first regular line of steamers across the Atlantic consisting entirely of iron ships propelled by the screw. December 10, 1850, the "City of Glasgow" of sixteen hundred tons and three hundred and fifty horse-power, the first steamship of what was then called the Liverpool, New York, and Philadelphia Steamship Company, sailed from Liverpool for Philadelphia, having previously made several successive and successful voyages to New York,[67] under other owners. In June,

[66] The English Peninsular and Oriental Company in 1875 for a service of 1,171,-092 miles received £430,000, while the Messageries Maritimes for a service of 631,-514, or little more than half as much, £399,838. It will be perceived both were pretty heavily subsidized.

[67] The 'City of Glasgow" left Liverpool last for Philadelphia, March 1, 1854, and is supposed to have foundered at sea, as she was never heard from. The vessel and cargo were valued at $850,000.

Mr. Inman having watched the performances of the "City of Glasgow" on her first trip to America, was convinced of the advantages she possessed over not merely sailing-ships, but over paddle-steamers, and therefore recommended her

1851, the "City of Manchester" was added to the line. It was not until February, 1875, that the line was converted, in honor of its founder, into the "Inman Steamship Company," limited.

New York having just become the port of the Cunard fleet, the new line did not wish to enter into direct competition with the older company, but in 1857 the "Inman" went also to New York, and having decided to name their ships for the leading cities of the world, had already added to its line the "City of Philadelphia,"[68] "City of Baltimore," "City of Washington," and "Kangaroo," and in 1860 they added the "City of New York," when the company's service became a weekly one.

In 1863 the "City of London," "City of Cork," "City of Limerick," and "City of Dublin" were added to the line, and the number of the trips increased to three times a fortnight, and afterwards to twice a week. The fleet in 1880 consisted of eleven vessels, varying in gross tonnage from two thousand five hundred and thirty-six to five thousand four hundred and ninety tons, and in nominal horse-power from three hundred and fifty to one thousand. Five ships have been built within the last seven years, four being among the largest and finest merchant steamships afloat, viz.: the "City of Chester," "City of Richmond," "City of Berlin," and the "City of Rome." The "City of Berlin" was launched October 27, 1874.

She has a gross tonnage of five thousand four hundred and ninety-one, is four thousand six hundred and thirty-four tons, builder's measurement, and has a net register tonnage of three thousand one hundred and thirty-nine tons. Her engines are one thousand nominal horse-power, but capable of being worked up to five times that amount of power. She is five hundred and thirteen feet in length over all, has four decks, and a moulded width of forty-five feet. These dimensions give her accommodations for two hundred saloon, or first-class, and fifteen hundred intermediate, or steerage, passengers, and a crew of one hundred and fifty men. The contract with her builders was that she should indicate five thousand horse-power and steam about sixteen knots. On her trial trip, at the measured mile, her engines indicated five thousand two hundred horse-power. She is propelled by a pair of inverted, direct-acting, compound high- and low-pressure engines. The low-pressure cylinder of these engines is one hundred and twenty inches,

purchase to his partners. Acting on his advice they bought and dispatched her with four hundred steerage passengers in the winter of 1850 across the Atlantic, and thus inaugurated what is now known as the "Inman Line." The "City of Glasgow" did her work well, and falsified the prophecies of disaster. The "City of Manchester" left a profit of forty per cent. the first year of her movement.

[68] "The City of Philadelphia," on her passage from Liverpool to Philadelphia, struck on Cape Race, September 17, 1854, and was lost; the vessel and cargo being valued at $600,000,—passengers and crew saved. In 1870 the "City of Boston" sailed for Europe and has never since been heard of.

and the high-pressure cylinder seventy-two inches in diameter, with a piston-stroke of five feet six inches. She has twelve boilers, heated by thirty-six furnaces, and they are so arranged that any number of them can be cut off.

Her saloon is amidships, and is forty-four feet in length by forty-three in width, longitudinally divided by two rows of walnut columns surmounted by gilded Corinthian capitals. It is lighted in the daytime by an elegant cupola skylight.

The following is a description of this vessel by a passenger. It may be well to compare his description of this modern colossal steamship with that of "Thalmamegus" described by Atheneus, built by Philopater, king of Egypt, and which was four hundred and twenty feet long, fifty-seven broad, and seventy-two feet high from the keel. The element of steam was of course wanting:

"There is certainly no finer steamer afloat, none more comfortable. Seated at dinner in her saloon, lounging in her smoking-room, or chatting with the ladies in their divan, you may easily forget you are at sea. The 'City of Berlin' has two decks, both of them superior to anything I have ever seen. You can have a promenade of nearly five hundred feet straight ahead, and the clean sweep of the lower deck from one end to the other is something superb. The lower deck looks like a little town, and it is a great deal pleasanter than most little towns. There is a row of handsome-looking houses, with a street open to the sea on either side. These houses, bright and neat, with their descriptions engraved on each in English, French, and German, are the officers' rooms, ladies' room, smoking-room, etc., all opening upon the deck on both sides, so that their ventilation and comfort are perfect. The smoke-room has electric bells and other conveniences. The ladies' public room is spacious, and filled with sofas and seats, so that the occupants can sit and chat with their male friends outside, or draw a curtain and shut themselves from all observation, or retire to a private room below (which opens upon lavatories and bath-rooms), and is one of the snuggest apartments in the ship, furnished in excellent taste and provided with luxuries and comforts undreamed of in private houses. In the companion-way hangs a list of the crew, and the boats to which they belong. The call is made every day; each man has his number, and in case of danger he knows exactly what to do. . . . The state-rooms are lighted from the deck by protected windows. In the best rooms, in addition to the usual berths, is a sofa made so that it can be converted into a berth large enough for two. The washing conveniences are such that you turn the taps in your state-room to wash with more confidence than if you had a London reservoir to draw from, there being between three and four miles of lead piping in the ship. The bath-tubs are all of white marble. You arrange the business of getting a bath with the steward. At the entrance of each bath is a slate, on which is inscribed

the passenger's name and the time at which the bath is devoted to him. Should he fail to appear, the others go on in rotation.

"The saloon is furnished in Spanish mahogany and purple velvet. There are four rows of tables, and the menu and wine-card is something to be remembered. The captain presides at one, the purser at another, the surgeon at a third, and some favored passengers at the fourth. The ship comprises within its vast domain a barber-shop, a butcher-shop, vegetable-store, kitchen, with lifts and shoots for the convenience of cooks and waiters, a bakery, a laundry, a surgery, hospital and infirmaries, and ice-houses. Indeed, nothing is wanting: even a light-house is provided. The sleeping accommodations are so arranged that by writing early, families or parties of eight, sixteen, and twenty-four can be berthed in private rooms."

The "City of Paris" in 1869 conveyed his Royal Highness Prince Arthur (now Duke of Connaught) to America in *six days twenty-one hours*, the quickest passage ever made to any part of the New World from Cork. The prince attended divine service at Queenstown on Sunday, embarked at 4 P.M. that day, and was landed at Halifax, Nova Scotia, at half-past 10 A.M. on the following Sunday in time for morning service at that place, which to his credit he also attended.

In 1874 the average time made by the fifty-one sailings of the Inman steamers between Queenstown and Sandy Hook, New York, a distance of two thousand seven hundred and seventy-five miles, was ten days, twenty-two hours, one minute, and the same year the "City of Chester" and "City of Richmond," the newest and swiftest of the line, made seven passages each, none of which exceeded nine days, the longest being accomplished by the "Richmond," in eight days, twenty-one hours, forty-one minutes, and the shortest by the "Chester," in eight days, one hour, thirty-eight minutes. These passages covered the whole year 1874, when the vessels were subject to all the different phases of the variable Atlantic. In December, 1875, the "City of Brussels" made the passage from New York to Queenstown in seven days, twenty hours, thirty-three minutes, the "City of Richmond" the same in seven days, eighteen hours, fifty minutes, and September and October the "City of Berlin" made passages both ways in seven days, eighteen hours, two minutes, seven days, fifteen hours, forty-eight minutes, and seven days, fourteen hours, twelve minutes.

The Inman was the first line to make special and extraordinary provisions for emigrant passengers, and during the ten years ending in 1863 had carried a yearly average of thirty thousand passengers, or three hundred thousand. The next ten years exhibited still better results, the number of passengers carried exceeding seven hundred and eighty-seven thousand, or an annual average of seventy-eight thousand seven hundred.

From 1850 to 1860 no mails were carried, Mr. Inman holding that

"ocean postage" was the proper way of paying for mail services rather than by monopolies and subsidies. When the Collins Line of American steamers were withdrawn the Inman came into the gap and carried the American mails, receiving for the service eight pence per half-ounce for letters, the postage being one shilling per half-ounce. The *Inman Company has never had a subsidy*, and has never been paid but for work done. When they came to agreement in 1867 with the Cunard Company to run a tri-weekly service to New York, they were paid thirty-five thousand pounds per annum for one sailing a week, which was less than one-half the remuneration they would have been paid under the ocean postage system. Thus the company carried the royal mail from 1868 until December, 1876, in conjunction with the Cunard. In 1877 the British government entered into arrangements with the Inman, Cunard, and White Star Lines (exclusively) to run the mails tri-weekly—viz.: Tuesday, Thursday, and Saturday—to New York.

On the 30th of December, 1881, the "City of Brussels" took from Liverpool to New York seven hundred and sixty sacks of mail matter, the largest shipment of that kind ever sent to New York.

The "City of Rome," launched on the 14th of June, 1881, at Barrow-in-Furness, by the Barrow Ship-Building Company, was regarded as the most appropriate name which could be given to the latest addition to the Inman fleet. Not many years ago Barrow was a handful of houses; it is now a town with thousands of inhabitants, whose prosperity depends upon the enterprise and ability which have led to the construction of the "City of Rome." The builders and owners of the vessel united to make the occasion memorable. A conspicuous proof of the friendly rivalry between the transatlantic companies was shown by the presence at the launch of representatives of the Cunard, White Star, National, and Allan lines. The launch, an undertaking of no small moment, was successfully accomplished; the ceremony of christening being performed by Lady Constance Stanley. The vessel arrived in the Mersey from her trial trip on the 14th of September following.

The decoration of ocean steamers is generally of a hybrid sort, not characteristic of anything in particular, and not always in the best of taste. In the "City of Rome" a consistent design has been harmoniously executed, and finds expression in richness of material rather than emphasis of color. An inspection of her saloons and cabins carries away a luxurious recollection of noiseless carpets, neutral hues, the flashings of beveled mirrors, gold and ebony panelings, embroidered curtains, silver lamps, stained glass, yielding cushions of green velvet, and faint designs of tapestries. The decorations belong to what has come to be known as the modern æsthetic, and have been chosen for their utility, appropriateness, and beauty. The figure-head, about three times life-size, represents a Roman emperor, Hadrian, modeled from the statue in the British Museum in strict conformity with its

model. The stern is enriched by festoons on either side the centre, being marked by a carving of the arms and crest of the city of Rome. As a compliment the municipality of the ancient metropolis sent a copy on vellum of the arms and crest of the city, which are hung up in one of the principal apartments of the vessel.

The dimensions of the "City of Rome" are: length, five hundred and eighty-six feet; extreme breadth, fifty-two feet three inches; depth of hold, thirty-seven feet; tonnage, eight thousand eight hundred and twenty-six tons; horse-power, indicated, ten thousand. The weight of this great steamer is eight thousand tons, and her displacement, at twenty-six feet mean draught, is thirteen thousand five hundred tons; so that she has a dead-weight carrying power of five thousand five hundred tons. The cubical contents of her hold give her a measurement capacity of seven thousand seven hundred and twenty tons, at fifty cubic feet to the ton. She is rigged with four masts, and has three funnels, and she has eleven compartments formed by water-tight bulkheads, each extending to the main deck. The largest of these compartments is sixty feet long; and supposing one filled with water, the trim of the vessel would not be materially affected. The stern frame, made at the Mersey Steel and Iron Works, is the largest forging ever made for such a purpose, the finished weight being thirty-three tons. The framing of the vessel is of the ordinary type: the floors are thirty-four inches deep at the centre line. The frames are in one length from centre line to gunwale, and are of angle-iron seven inches by four inches, and sixty feet in length. The reverse frames are in one length of four inches by four inches angle-iron. The beams are of the Butterley bulb sections, each rolled in one length. The vessel has two complete iron decks above, while the lower deck is complete for half the length, and has wide plating on each side of the remainder. The "City of Rome" has nine keelsons. The five central ones are of uniform height, so as to be carried unbroken through the engine- and boiler-seatings. The shell plating is on the principle that has been applied to all the large transatlantic steamers built in Barrow. The inside plates form a complete skin, fitted edge to edge and butt to butt, with covering plates half the width of the inside strakes fitted outside. The hold stanchions are arranged in two tiers, one on each side, the better to support and strengthen the long beams. The question of propelling the ship at so high a speed as eighteen knots per hour demanded careful consideration, and it was ultimately decided that it would be best to adhere to the single-screw arrangement, and adopt a propeller twenty-four feet in diameter, driven by three sets of inverted "tandem" engines, working on three cranks disposed at an angle of one hundred and twenty degrees with one another. The "tandem" engine has the high-pressure cylinder placed in a line behind or above the low-pressure cylinder. The crank-shaft is a built shaft,

and, with the screw shafting, was made by Sir Joseph Whitworth & Co. of their fluid compressed steel. The leading particulars of the engines are: there are three high-pressure cylinders forty-three inches diameter, and three low-pressure cylinders eighty-six inches diameter, and six-feet stroke. The diameter of the crank-shaft is twenty-five inches, and of the crank-pins twenty-six inches. The length of the main bearings is thirty-three and one-half inches, and of the crank-pins twenty-eight inches. The crank-shaft weighs sixty-four tons; had it been made of iron, and solid, the weight would have been seventy-three tons. The propeller shafting is twenty-four inches diameter, and the hole through it fourteen inches diameter. The thrust-shaft has thirteen collars thirty-nine and one-half inches diameter, giving a surface of six thousand square inches. This piece of shafting weighs seventeen tons. The propeller-shaft is twenty-five inches diameter and thirty and one-half feet long, and weighs eighteen tons. The bed-plate weighs one hundred tons. The cooling surface of the condensers is seventeen thousand square feet, equal to nearly seventeen miles three hundred and sixty yards of tubing. There are two air-pumps, thirty-nine inches diameter, and three feet stroke, worked by levers attached to the aft and forward engines. There is a pumping-engine, which can be used for pumping heavy leaks, or can also discharge through the condenser. There are also three auxiliary pumping-engines, for feeding the boilers, for bilge-pumping, and for deck purposes. Steam is supplied by eight cylindrical tubular boilers, fired from both ends. Each boiler is fourteen feet mean diameter and nineteen feet long, with a steam-receiver thirteen feet long and four feet diameter; and has six furnaces three feet nine inches diameter, three at each end: forty-eight furnaces in all. The fire-bars are six feet long, giving a grate surface of one thousand and eighty square feet. The shell plates of the boilers are twenty-four feet eight inches long, four feet four and one-half inches wide, and one and one-fourth inches thick, and weigh nearly two and one-half tons each; all the holes are drilled. Each furnace has its separate combustion-chamber. These boilers are constructed for a working pressure of ninety pounds per square inch. The engines are intended to work constantly at eight thousand indicated horse-power, but are capable of developing ten thousand horse-power, indicated.

It is difficult, indeed impossible, to convey in words an adequate idea of the engine-room. All received ideas on the subject are upset. Four Serrin lamps render it as bright as day. These lamps have no glass shades, and give no trouble. It may, perhaps, help a little to realize what her engines are when we state the engine-room is fifty feet wide and of about the same length. The engines are forty-seven feet eight inches high from the bottom of the frames to the tops of the high-pressure cylinders; that is to say, about as high as an ordinary four-story house. Access to the engine-room platforms is not by lad-

ders, but by iron staircases, which will take three persons abreast. Entering from the upper deck, nothing is to be seen but the three high-pressure cylinders and the lids of the low-pressure cylinders, a close grating concealing all the rest of the machinery below. Descending the first flight of stairs, which runs fore and aft, we are on the second platform surrounding the low-pressure cylinders, which is the only hot place in the engine-room. Passing between the cylinders and the steps we have descended, we come to a second flight, aft of the engines, and running athwartships, and descend to the third platform, from which access is got to the two stuffing-boxes in the lower lid of each low-pressure cylinder. Standing here and looking forward between the frames, we have a sight unique. We see the three mighty crossheads with their guides, and the jaws of the great connecting-rods moving up and down in rhythmical sequence in the vivid glare of the electric lamps, which cast strong shadows on the white bulkheads. Passing to the lower floor again, we have before us the like of which can nowhere else be seen. Here is ample room to walk about; there is no steam to indicate the presence of an engine, for the cylinders are high over our heads. We look up and see the black covers looming far above. Then straight before us is the crank-shaft. As we look at it we realize that it is the largest crank-shaft in the world; it weighs sixty-six tons. Each of three cranks with its shafting occupies a length of fourteen feet, and weighs twenty-two tons. A tall man standing beside one of the cranks is dwarfed. Each crank-pit is a chasm. The rush of water from the pipes over the bearings is caught, and the crank, which has given so much trouble, scatters a light spray, the drops gleaming like jewels in the electric light. The noise is monotonous, but not wearisome. The great connecting-rod brasses are just a little slack, and the want of lead in the slides makes the pistons slow in getting away from the cylinder-covers; and we have, as the cranks revolve, not a blow or a knock, but a soft, all-pervading thud as each centre is turned. Away aft runs the main screw-shaft twenty-four inches in diameter. The thrust-shaft has twelve collars four feet in diameter, and weighs seventeen tons. Following it down the long tunnel we lose by degrees all the sights and sounds of the ship. Then a noise as of a village water-wheel, a pattering and murmuring of water, reaches us. Standing on an angle-iron brace we look through a hole in the last bulkhead in the ship, and see by the light of an engine-room lamp a small pool of water under the end of the stern-tube, and in this pool dips the last coupling, four feet in diameter like its fellows, and the nuts and the heads of the bolts of the coupling patter in the water, and make the sounds which have different associations. It may be well to explain with reference to the engines that the bald figures of horse-power do not express the true significance of the progress which has been made in that department of naval science. The

engines now in use are not only infinitely more powerful, but they are relatively more economical. The engines with which earlier vessels were equipped have been superseded by the high- and low-pressure engines (compound condensing), which accumulate force and utilize the steam more fully, so that with a reduced consumption of fuel there is an increased power of propulsion. Without this progress in engineering skill the development of steam navigation would have been impossible. Either the vessels could not have carried a sufficiency of fuel, or the storage of it would have engrossed so large a proportion of the cargo space that they could not have been worked profitably. An example of the revolution in the engine-room may be cited from one of the Inman steamers. The "City of Brussels" was placed on the line in 1869, when she was regarded as a model of nautical excellence; in fact, the "crack" ship of her day. But within seven years of her launch, while her hull and sailing appointments were in undiminished efficiency, her machinery had become antiquated, and she was furnished with entirely new engines. This costly renovation was made, with the result that by the new compound engines equal power was attained on a much smaller consumption of coal. It is needless to explain that to save forty to fifty tons of coal per day was a direct economy of fuel, also a gain of space for the stowage of freight-earning cargo. In fact, by the change of engines the consumption of fuel was reduced from about one hundred and ten tons per day to less than sixty-five tons, and the cargo space augmented by about eight hundred tons, with an increase of propelling power. Compound engines have introduced a revolution almost as complete as did the paddle-wheels and the screw, and are now of course universal in ocean-going steamers, one of the largest sets ever constructed being fitted on board the "City of Rome."

On the trial trip of the "City of Rome," working at three-quarters speed, with forty-five revolutions per minute, the measured mile was performed at the rate of fifteen and three-fourths knots per hour; but as the engines at full speed make fifty-eight or sixty revolutions per minute, the ship will in practice attain a speed of seventeen and one-half or eighteen knots per hour. In the series of tests the engines worked with great smoothness, and it was demonstrated that the engines could be brought to a dead stop in two seconds by the turning of a single lever, and that from going full speed ahead, they could be reversed to full speed astern in the space of five seconds.

The internal arrangements of the "City of Rome" are of the most complete nature. The promenade-deck carries at the fore end the saloon skylight. In the hurricane deck-house the captain's and chief officer's cabins are placed close to the steering-house and lookout bridge, so that they are always near in case of necessity. Abaft this is the upper saloon companion, and abaft this again the large upper smoking-room, which is a novel feature in this ship, it being thought

advisable, in view of the large number of passengers, to fit two smoking-rooms, each with separate stair to the cabin-deck. In the after deck-house is a deck saloon or lounge for ladies, which is fitted up in the most elegant manner, and prevents the necessity of going below in showery weather. Abaft this is a companion leading to the after end of the sleeping-cabins. At the sides of this hurricane-deck are carried twelve life-boats, one of which is fitted up as a steam-launch. On this deck are also placed the capstans, and at each of the cargo hatchways are the steam-winches for working the cargo. On the upper deck is the upper saloon, or drawing-room, about one hundred feet long, for the use of passengers. This apartment, which is fitted up very handsomely, with lounges round the sides, is in the form of a wide gallery with a large rectangular opening into the dining-saloon below, thus giving great height and light to the latter apartment. Above this opening is a large skylight, richly ornamented, at the fore end is a grand piano, and at the after end the grand staircase leading to the dining-room below. Here, also, is the lower smoking-room, which is fitted similarly to the upper; the paneling of these rooms is in wainscot oak, the floor is laid in mosaic pavement, and the upholstery in morocco leather. Abaft this are the rooms for the officers and engineers, exceptionally large and lofty. The height in the 'tween decks is nine feet. The grand dining-saloon is seventy-two feet long, fifty-two feet wide, and nine feet high, or seventeen feet in the way of the large opening to the drawing-room above. This opening, surmounted by the skylight, forms a very effective and elegant relief to the otherwise flat and heavy ceiling. The paneling and decorations are highly artistic and quite unique. The apartment accommodates two hundred and fifty first-class passengers. The chairs are made of polished teak-wood, neatly fluted, with the Inman monogram carved in open work. They revolve on pivots, and are all numbered to correspond with the state-rooms, so that each passenger at once finds his seat. At night the saloon is lit by thirty-two Swan incandescent electric lamps, pendent from the ceiling, giving the whole a brilliant appearance. A paneled dado, of quaint design, three feet high, is carried entirely round the saloon, and from the dado cornice to the line of the ceiling the wall is treated with rich panels of figured mahogany, bordered with a margin of satin-wood, alternating with the side-light casings. These side-lights are rather more architectural than is usually found on board steamships. An architrave is carried in a square form round the side-lights, inclosing a secondary sill, and runs down to the top of the dado. From the centres of each of the intermediate panels the corbels (which are elaborate pieces of moulded and carved oak) spring, making the main lines of the ceiling construction, and carrying them down on the walls. At the level of the corbel capitals the ceiling rises upon elliptic arches between the beams, suggesting in a measure the fan vaulting, which is so beau-

tiful a feature in Gothic architecture. The music-room, which is immediately above the saloon, is rather more severe in its style, being finished in black and gold, and the room itself is surmounted by a very handsome circular skylight, twenty feet long by ten feet wide, which throws down a flood of light to the dining- and music-rooms. A special feature in this skylight is the introduction of oval lights, which are enlarged to double the area where they pass into the ceiling of the dining-saloon. An organ is fitted up in the dining-saloon, and a grand piano in the music-room. The ladies' boudoir, on the main deck, is fitted out in a very handsome manner, the walls being paneled in rich figured brocaded silk, and the ceiling in Japanese leather paper. The couch is upholstered in blue velvet, with tapestry curtains. Alongside of this are baths, etc., for the lady passengers. On the hurricane-deck is another boudoir, treated, as a contrast, with black and gold. The furniture and upholstery of this room is of amber-colored plush velvet, and the window-hangings and door portière are of Roman cloth of the same tone, banded with stripes of plush. The smoking-rooms are beautifully fitted up, that on the saloon-deck having a novel treatment of wall paneling, consisting of original Japanese water-color sketches of birds and flowers, drawn with that remarkable character peculiar to the Japanese. The seats are covered entirely with pig-skin leather. The wood-work of the walls, etc., in the upper smoking-room is of pencil cedar-wood, and in the lower of mahogany, oak, and walnut. The floors of those apartments are laid with parquetry. Just abaft the music-saloon are the various repositories for the plate and dishes required for the service of the table, and abaft of that the cook's and steward's portion of the ship is to be found. The breadth and general style of the kitchen may surprise some at first sight, but when the number of passengers to be fed is taken into account wonder at the gigantic proportions for feeding them will cease. Four hundred cabin passengers and eighteen hundred steerage, together with about two hundred and forty of a crew, may have to be provided for on a voyage, and in that aspect of the matter the rooms for cooks and stewards are none too many. Going aft beyond the regions where the cook presides, we come on the engine-room. Nearer the stern still we come to the quarters of the steerage passengers, and these are, though of course not rich like the cabin, at least roomy and clean to a degree that would surprise old Atlantic stagers. Still aft there is an engine at work for the service of the electric light, with which the whole ship is to be fitted; and an ominous notice warns all who come near that instantaneous death may be the result of incautious handling of the wires. At the very stern there is the ponderous steering apparatus, although the place from which the steering is to be done is far off on the captain's bridge, where there is the now familiar little wheel which is used in steering by steam.

The crew numbers, when the full complement is aboard, about two hundred and forty. There are berths for fifty-four firemen and about fifty seamen, while over one hundred are in the cook and steward's department, and about twelve directly connected with the engine-room.

Opening off through double spring-doors at the foot of the grand staircase and under is a handsome American luncheon-bar, with the usual fittings. On each side of the vessel, from the saloon to the after end of the engine-room, are state-rooms, providing for about three hundred passengers. Amidships are retiring-rooms, baths and lavatories, barber's shop, etc. Accommodation is provided on the main deck for about five hundred emigrants. Accommodation can also be provided on the lower deck for one thousand emigrants more, making a grand total of fifteen hundred. This class of accommodation the Inman Company has always given special attention to. The berths are arranged in single tiers or half-rooms, each being separated by a passage and having a large side-light, thus adding greatly to the light, ventilation, and comfort of the passengers, besides the advantage of a lesser number of persons in each room. Comfortable wash-rooms are provided for both sexes, fitted with looking-glasses, soap, towels, etc.

In proportions and design the "City of Rome" presents a remarkable contrast to the "Great Eastern," to which she stands next in magnitude in the mercantile marine. Brunel's vessel suggests the air of a stately ark, with towering walls and ponderous hull, massive, stupendous, rather than elegant. The conditions are reversed in this vessel. The "City of Rome" is of great length, of tapering form, symmetrical lines, and graceful mould, so that the inexperienced observer is scarcely able to realize her enormous dimensions. The difference of proportions between the two vessels shows how scientific theory is modified by practical experiment. In designing the "Great Eastern," Brunel had no other guide than his scientific knowledge; there were no gradations between the puny vessels of five-and-twenty years ago and the leviathan he constructed; and he reckoned the length, beam, and depth on bases which the practice of later ship-building has not confirmed. The tendency of naval construction in the merchant navy is to lengthen the hulls, without in any appreciable degree increasing the beam or depth of the hold. This is at once apparent by comparing the dimensions of these typical vessels, the "Great Eastern" and the "City of Rome." The length of the former is six hundred and eighty feet; her breadth of beam, eighty-three feet; depth, sixty feet. The measurements of the "City of Rome" are: length, five hundred and eighty-six feet; breadth of beam, fifty-two feet three inches; and depth of hold, thirty-seven feet; so that while in length she closely approximates to her rival, in breadth and depth she is little more than half the magnitude. It is in these differences of proportion that the disparity of tonnage is to be found. The "Great Eastern" is of enormously greater cubical capacity,

as may be inferred from her breadth and depth; but, though less tall and bulky of hull, the "City of Rome" is of great cargo capacity. The length of the vessel and her beautiful lines suggest an impression of buoyant grace rather than of vast magnitude; yet her carrying power, notwithstanding her clipper bow and rounded stern, is greater than that of any other vessel afloat, except the "Great Eastern."

With the latest vessels added to the fleets of the Cunard, the Inman, the Guion, and the Anchor Companies, it is possible to gain a good idea of the ocean ships of the future. So far as size, speed, and comfort are concerned these are just as much in advance of the Atlantic liners of which we were so proud a quarter of a century ago, as those were improvements on the earliest specimens of river passenger steamers. A great point was thought to be reached when the Cunard Company built the "Scotia" and the "Persia," or when the Inman Company became possessed of the "City of Glasgow"; but the finest of these steamers was not much above half the size of the "Servia" or the "City of Rome," whilst its engine-power was comparatively infinitesimal. No better illustration, perhaps, of the changes that have taken place in our ocean fleet could be given than a reference to the statistics bearing on the size of some of the early and some of the latest Atlantic liners. The Cunarder "Scotia," which was launched on the Clyde about 1862, and was then considered the best specimen of her type, measured three hundred and seventy-nine feet in length, and had a breadth of forty-seven feet eight inches, and a depth of thirty feet five inches. Her tonnage was three thousand eight hundred and seventy-one, and she was fitted with side-lever engines indicating one thousand horse-power. The "City of Glasgow," built for the Inman Company some years earlier, measured two hundred and seventy-seven feet long by thirty-two feet seven inches broad, and twenty-four feet seven inches deep. She was sixteen hundred tons burden, and her engines were three hundred and eighty horse-power. According to popular theory the full limits of practicable ship-building were reached five years ago, when the "City of Berlin" was introduced into the fleet, she being then the largest vessel afloat (always excepting the "Great Eastern"), and it being assumed that finality had been reached in the magnitude of ocean-going steamers. Her measurements, in contrast with those of the pioneer of the service, testify to the progress which twenty-five years had witnessed in the development of steam navigation. Her length is five hundred and twenty feet, breadth forty-four feet, depth to spar-deck thirty-seven feet, and her gross measurement five thousand four hundred and eighty-one tons. Her engine-power being nine hundred horse-power nominal, but capable of working up to four thousand eight hundred horse-power indicated. Compare these figures with the dimensions of the "Servia" or the "City of Rome." The "Servia" has a length of five hundred and thirty feet,

a breadth of beam of fifty-two feet, a depth of forty-one feet, a carrying capacity of at least eight thousand five hundred tons, and is fitted with engines calculated to develop an indicated horse-power of ten thousand five hundred tons. The "City of Rome" is: length, five hundred and eighty-six feet; breadth, fifty-two feet three inches; depth, thirty-seven feet; tonnage upwards of eight thousand; and engine-power, ten thousand. Facts like these are striking enough, but they fail to exhaust the comparisons which might be drawn between the vessels formerly engaged in the ocean traffic and the ships which are now taking their place. Those who may inspect the "Servia" or the "City of Rome" will become aware of an untold number of ingenious contrivances by which the comfort, and it may be added the safety, of passengers are now assured. The vessel of the future is not only a model of speed and of large cargo capacity, it is also a model of luxury.

Where, it may be asked, is this peaceful rivalry in the production of big ships to stop? Are ship-builders and ship-owners to go on increasing the size of the ocean-liners until they rival the "Great Eastern"? It is impossible to place any limit on such an enterprise; but it may safely be taken for granted that if ships of the dimensions of the "Great Eastern" should become necessary, the errors which have made her failure conspicuous will be avoided. It is evident that if Mr. Brunel in building that vessel had adopted the principle of the compound engine, her fate might have been different. Instead of being under the necessity of putting the great ship up to auction after a by no means brilliant career, the shareholders might be enjoying the profits which are to be reaped in ocean transport. The only danger is that in the race for the possession of huge floating palaces the great steamship companies may outrun the wants of travelers. If the ocean fleets of the future are to be composed of such vessels, an enormous increase of the traveling public will be necessary to the continued prosperity of the industry. Any improvement in the facilities with which a trans-atlantic voyage can be made is sure to bring its own reward. The time when ocean travel was attended with misgivings or was a luxury reserved for men of wealth and leisure has passed away. With the appearance of ships that will traverse the Atlantic in less than a week, a holiday trip to Europe may become as cheap as it is restorative. The president of the Scotch Engineers and Ship-Builders' Society recently declared that in a few years "we shall have steamships starting from each side of the Atlantic every morning, noon, and night, and arriving on the opposite shores with as much regularity as our present express railway trains arrive at the termination of a journey of four or five hundred miles."

In their passenger accommodations the ships of the Inman Line are much superior to most Clyde-built ships, and their design shows an inclination to break from the restrictive and uninventive habit which

is said to hamper the British ship-builder. "Give an English carpenter a certain space in an unfinished ship, and tell him to fit it up as, for instance, a chart-room," a gentleman connected with one of the lines recently said, "and he will repeat exactly what he did in fitting up the previous ships, without stopping a moment to consider if some change is not desirable and possible. An American carpenter, on the contrary," this critic, who was an Englishman, continued, "will rack his brains for improvements, and the ship he fits up to-day is sure to be more comfortable than the one he fitted up yesterday."

The following vessels have been bought and built or have passed through the company's hands since its establishment in 1850:

Name.	Built.	Length.	Breadth.	Depth.	Tonnage. Gross.	Net.	Name.	Built.	Length.	Breadth.	Depth.	Tonnage. Gross.	Net.
City of Rome	1881	600	52	37	8415	.....	City of Boston	1864	313	39	26	2213	1649
City of Berlin	1874	489	45	36	5491	2957	Ætna [2]	.....	309	37	27	2190	1564
City of Richmond	1873	450	44	35	4607	2824	City of Dublin [3]	.....	318	36	26	1999	1548
City of Chester	1873	444	44	35	4566	2713	Edinburgh [4]	.....	300	40	25	2197	1494
City of Montreal	1872	419	44	34	4489	2939	City of Philadelphia [5]	1854	294	39	26	2168	1648
City of Brussels	1869	390	41	35	3775	2434	Glasgow	.....	262	36	25	1962	1152
City of New York (enlarged)	1865	375	40	33	3499	2380	Vigo [6]	.....	270	35	25	1953	1250
City of Paris	1866	398	41	26	3081	1975	City of Manchester [7]	1852	262	36	25	1906	1296
City of London	1863	374	41	26	2765	1880	Kangaroo [4]	.....	257	36	27	1719	1169
City of Brooklyn	1869	354	43	27	2911	1980	City of Glasgow [5]	1850	227	33	25	1609	1087
City of Washington	1853	358	40	26	2870	1951	Nemesis	.....	253	42	28	2717	1587
City of Bristol	1860	349	38	27	2655	1805	City of Cork [7]	.....	265	33	26	1547	1082
City of Antwerp	1867	332	39	26	2391	1626	City of Halifax [3]	.....	204	30	18	770	523
City of Limerick	1863	331	34	30	2536	1724	City of Durham [3]	1865	201	29	17	697	538
City of New York	1865	326	40	28	2360	1679	Bosphorus	1856	174	24	15	448	343
City of Baltimore [1]	1854	326	39	26	2472	1774	Hercules	1856	122	23	10	211	174
							Ajax	1856	108	23	9	163	133

[1] Sold March, 1874, and now running between Liverpool and Bombay. [2] Purchased from Cunard Co.
[3] Sold 1872. [4] Sold 1869. [5] Lost 1854. [6] Sold 1861. [7] Sold 1871.

The present fleet of the transatlantic steamers of the Inman Line are:

Name.	Built.	Gross Tons.	Name.	Built.	Gross Tons.
City of Berlin	1874	5491	City of Montreal	1872	4490
City of Richmond	1873	4607	City of Brussels	1869	3775
City of Chester	1871	4566	City of New York	1865	3500
City of Paris	1865	3091	City of Rome	1882	8415

The Anchor Line, 1856–1881.—Some fifty years ago four little Scotch boys started from the Clyde in little smacks, then served consecutively in schooners, brigs, barks, ships, and steamers, until conversant with every detail connected with all these types of vessels, with knowledge acquired and sterling integrity, and practicing economy, they grew up to manhood, and saw attempts made to establish steam traffic between Glasgow and the Western Continent, and as often saw them fail. In due time they banded together, and these little Scotch boys became the well-known firm of "Handyside & Henderson," of Glasgow,

the originators of the "Anchor Line." Their first efforts were in small sailing-vessels in the Mediterranean fruit trade, and they finally purchased the steamer "Inez de Castro" and another small craft. They then altered the ship "John Bell" into an auxiliary steamer, and another sailing-ship, "Tempest," in the same manner, and with these two vessels inaugurated the Anchor Line. The story of the "Tempest," the pioneer of this line, is soon told: "*The good die young.*" She was lost on her second return trip.

The Anchor Line came into existence, with these two converted vessels, in 1856, and as early as 1872 seventeen steamships had been constructed for its service between New York and Glasgow, besides thirty steamships for its service in the Mediterranean. At the present time (1881) steamships of the line, carrying the United States mail, sail from New York every Saturday, calling from Londonderry on the voyage from Glasgow, and from Glasgow every Thursday, also from London every Saturday, sailing the same day of the week from New York for London. There is also a branch of this line sailing between Barrow-in-Furness (touching at Dublin) and New York about once a fortnight. For several years the company applied its energies in developing the Peninsular and Mediterranean branch of their service; but in 1863 determined to vigorously prosecute the Glasgow and New York trade, and built the "Caledonia" and "Britannia." In 1868–70 serious disasters befell the company, and in a few months they chronicled the losses of the "Hibernia," "United Kingdom," and "Cambria."

On the arrival of the "Iowa" at New York, June 29, 1867, the celebrated dwarfs, Tom Thumb and wife and Commodore Nutt and wife, who were passengers, united in a letter of thanks for the care and attention they had received.

The company flag, which gives name to the line, is a white burgee on which is borne a red anchor horizontally.

On the 14th of August, 1872, the owners and agents of the Anchor Line signalized the advent of their latest and at that time best steamer, the "California," an iron screw steamship of 3208 gross tons, 361.5 feet length, 40.5 feet beam, and a working horse-power of 1047, by an excursion to Long Branch. The company numbered four hundred, and after an absence of eight hours returned to New York City. The band of the Seventh Regiment and two bagpipers in Highland costume entertained the company, and the whole four hundred guests were at *one time* seated at tables spread between decks, provided with every delicacy that the markets of the Old and New World afforded.

A passenger describing the "California" says, "The grand saloon, forty-five feet long by forty wide, is finished in a scale of magnificence which is carried out in every part of the floating palace. The paneling is of polished oak, interlaid with rich dog- and white-wood, adorned with rich carving and gold. The smoking-saloon is luxuriously

fitted, and painted in a tint of sea-green, and silver-plated chandeliers drop from the ceiling. Each state-room has its electric bell. Two large bath-rooms are on each side of the vessel. The ladies' boudoir is decorated in sea-green tints, dotted and striped in gold, with delicate birds perched in the centre of each broad panel. She has accommodations for one hundred and fifty first-class, and nine hundred steerage passengers."

The present fleet of the Anchor Line is as follows, the names of the vessels being alphabetically arranged, and with but two exceptions ending in "*ia*":

Transatlantic, Peninsular, Mediterranean and Oriental Steamships in 1881, *with their Registered Tonnage.*[*]

	Built.	Tonnage.
Acadia	1866	1081
Alexandria	1870	1629
Alsatia	1876	3000
Anchoria	1875	4176
Armenia	.....	3380
Assyria	1871	1628
Australia	1870	2243
Belgravia	.....	5000
Britannia	1863	2200
Bolivia	1878	4050
Caledonia	1872	2125
California	1872	3287
Castalia	1878	2200
Circassia	.....	4200
Columbia	1867	2000
Devenia	.....	4200
Dorion	1868	1038
Elysia	1878	2738
Ethiopia	1878	4004
Furnessia	1881	5496
Galatia	.....	3125
Hesperia	.....	3125
Hispania	.....	3380
India	1869	2289
Ischia	.....	3125
Italia	1872	2245
Justitia	.....	3125
Macedonia	.....	2272
Olympia	1872	2050
Roumania	.....	3500
Scandinavia	1865	1135
Scotia	1866	1103
Sidonian	1870	1235
Trinacria	1871	2107
Tyrian	1869	1038
Utopia	1873	2731
Victoria	1872	3242

The "Furnessia," the latest addition to the fleet, was built by the Barrow Ship-Building Company at Barrow-in-Furness, Lancashire, England, and was, when launched, the largest vessel ever built in England save the "Great Eastern." She has since been surpassed by the "City of Rome," "Servia," etc. Her dimensions are: length, 445 feet; beam, 44 feet 6 inches; depth of hold, 34 feet 6 inches; her registered tonnage is 5496; gross tonnage, 6500 tons, and her displacement when drawing twenty-six feet of water, 9900 *tons*. She is brig-rigged, and has two funnels. Her engines are 3500 horse-power. The diameter of the propeller is 20 feet 6 inches. The engines, fitted with Roger's patent exhauster, have special fire-engines and emergency pumps for pumping in case of collision or accident. She has

[*] The date of building is given when known. Those whose date of building is not given have been built since 1873.

steam steering-gear, winches, cranes, etc., and her hull is divided into *nine* water-tight compartments.

A full description of the passenger arrangements cannot be given in a brief notice. The promenade-deck, which stretches from nearly amidships to the stern of the steamer, is surmounted by a deck-house, of which one-half is utilized as a comfortable smoking-room. Opposite the entrance to the smoking-room is a staircase which descends to the music- or drawing-room on the spar-deck. The walls of this music-room are lined with panels of walnut and satin-wood. The seats around the apartment are upholstered in brown morocco, and around the staircase leading to the main deck are ornamental boxes filled with exotic plants. It is also furnished with a Broadwood piano and a Mason & Hamlin organ, and a well-stocked library. A broad, airy corridor, lighted and ventilated by skylights at frequent intervals, leads from the music-room aft, on either side of which are state-rooms elegantly and comfortably fitted up, having two berths and a sofa in each. Descending from the music-room by a broad staircase the dining-saloon is reached. The port-holes of this saloon are hid by window-frames with stained glass, and the carpets, curtains, and other accessories display the taste and elegance which are everywhere evinced.

The dining-saloon is heated by steam, furnished from two Baltimore heaters fitted into white marble mantels. A corridor, similar to that on the spar-deck, stretches from the main saloon aft, giving access on both sides to state-rooms, which are each fitted for the accommodation of four persons. There are two state-cabins furnished with special magnificence, which, in place of the ordinary berths elsewhere provided, are supplied with Parisian electro-plated bedsteads.

THE NORTH GERMAN LLOYD STEAMSHIP COMPANY was founded in 1857 by a number of enterprising business men of the ancient and wealthy city of Bremen, a city belonging to the so-called Hansa-Bund, or commercial confederation of German free cities, whose merchants in the thirteenth century sent their ships out over the German Ocean and up the Baltic, and gave the first incentive to the trade of northern Europe, which they controlled for centuries. True to the traditions of their forefathers, the inaugurators of this new line of communication with the Western Hemisphere determined to offer to the public in place of the slow and uncertain sailing-vessels, by which all living and dead freight had been forwarded from the port of Bremen, a quick, safe, and commodious fleet of steamers.

The founders of the line were sensible that, in order to succeed in the new undertaking, it would be necessary to conduct the management with a jealous regard for the comfort, safety, and well-being of the passengers. They were obliged to contend with the prejudice of many unable to comprehend the grand revolution in ocean transportation taking place, who would not intrust their lives and goods on these

new-fangled arrangements driven by steam and moved by complicated machinery, liable, as they opined, to continual derangement. Founded on the maxim that that company serves its own interest best that serves the public best, the line, in spite of the opposition of early years and the eager competition of later days, grew and prospered. Up to December, 1878, the steamers of this company had made two thousand five hundred and fourteen voyages across the Atlantic, and carried more than six hundred and eighty thousand persons over the ocean. Of this number more than one hundred and eight thousand were cabin passengers, all of whom were conducted safely and well over its stormy sea. This is a record few steamship lines can equal, and that hardly any can excel.

The transatlantic steamers of this line, thirty in number, with the exception of four built on the Humber, were all built on the Clyde. They are iron screw steamers with flush decks, built according to the English Lloyd rule. The length on an average three hundred and sixty feet, breadth of beam forty feet, and depth thirty-two feet, the length being about nine times the breadth. Tonnage about three thousand five hundred tons. They are provided with iron decks, and seven water-tight compartments. Their draught without cargo is seventeen feet, and with cargo twenty-one feet. They are brig-rigged, spreading fourteen thousand square feet of sail, carry ten iron life-boats twenty-eight feet long, and the other usual appliances for saving life. The engines of nearly all of these ships are of the compound type. The screws are of iron, with four blades about fifteen feet in diameter, and with a pitch of about twenty-four feet. The larger steamers have twelve main boilers, with two furnaces and one auxiliary, and the average speed of the mail steamers, viz.: "Neckar," "Oder," "Mosel," "Rhein," "Main," "Donau," "Freser," and "America," plying between Bremen and New York, is stated as fourteen and one-half knots per hour.

A new steamer, to be called the "Elbe," is being built on the Clyde, and will soon be placed on the line between Bremen, Southampton, and New York.

The "Elbe" is of five thousand tons measurement, and her dimensions are four hundred and twenty feet in length by forty-five feet breadth of beam, and forty feet depth of hold. She is provided with seven water-tight compartments, and fitted with four masts, the fore- and mainmasts square-rigged, and the two mizzen-masts schooner-rigged. The upper deck fore and aft is covered over. She has a hurricane-deck amidships one hundred and eighty feet long, as a promenade-deck for first-cabin passengers, on which the ladies' cabin is placed near the mainmast.

The "Elbe" has the most approved steam steering-gear, operated from the wheel-house, which is placed under the bridge and at the forward end of the hurricane-deck.

Her engines are of six thousand horse-power, indicated, and consist of three cylinders, the high-pressure of sixty inches diameter, and the two low-pressure of eighty-five inches diameter each, and guaranteed to obtain a speed of sixteen miles an hour. The crew is one hundred and sixty all told.

The smoking-rooms are on deck, one forward and the other aft. The first cabin and saloon amidships extends from side to side of the steamer, with the state-rooms partly forward and partly aft of the saloon, and all the state-rooms are "outside" rooms. The second cabin state-rooms are located on both sides of the second cabin saloon aft. All the state-rooms are of large size, and they will accommodate two hundred cabin passengers. The upper deck space allotted to second-cabin passengers as a promenade-deck is aft, on what is usually known as the quarter-deck.

A steamer of this line leaves New York every Saturday for Southampton and Bremen, and one sails as often from those last-named ports for New York.

The officers in the employ of the North German Lloyd Steamship Company are obliged to pass two rigorous examinations in the German nautical schools before they can obtain a position, and all have begun their career before the mast and worked their way step by step upward.

THE WHITE STAR LINE, 1870.—The establishment of this line of steamships it is claimed was a new departure in ocean steamship management.[70] The ships differed in their model, their internal arrangements, and their equipments from all their predecessors. They were designed to combine the highest attainable speed with unprecedented comfort and convenience for passengers.

Nautical critics are peculiarly conservative, and look with great distrust upon all marked innovations in naval construction, and these new vessels were the subject of very unfavorable comments. They might do for summer passages, but grave doubts were expressed whether they would endure the test of a North Atlantic winter. It was an innovation also that the vessels of the line should be built at Belfast instead of upon the Clyde, the stipulation with their builders being that the ships were to be constructed of strength, size, and power equaling, if not surpassing, anything upon the Mersey. The builders were not limited by any contract, but were left to themselves to fulfill the general instructions given. When the first vessels of the line were brought around to Liverpool from Belfast they created a "genuine

[70] The White Star Line was originally composed of a fleet of fast-sailing American clipper-ships, such as the "Champion of the Seas," "Blue Jacket," "White Star," "Shalimar," etc., sailing to Australia. To this line Messrs. Jenay Imray & Co. succeeded, and they still carry it on with similar fast high-classed vessels, built of iron, and they have applied the title "White Star" to their New York line of steamers.

sensation," and became the subject of general comment and observation. Events have proved that the builders reached a high degree of perfection in speed and safety, and that no steamships have been better able to cope with the winter storms of the Atlantic. For ten years, in winter as in summer, the steamships of the White Star Line have been unsurpassed for speed, safety, and comfort, and have lived down all adverse criticism. The best evidence of the value of the improvements introduced by the White Star Company is that they have been gradually adopted by rival lines. The White Star steamers range from three thousand seven hundred to five thousand tons, and are among the largest in the world. They are built with regard to strength no less than speed, and are constructed on the floating-tube principle, with seven water-tight and fire-proof iron bulkheads. They are steered by steam, and have the principal saloon and state-rooms amidships. A complete inspection by the commanding officer is made before every voyage, when the men are put through a boat-service drill and a drill in defense of fire, which is repeated once or twice at sea on each voyage. The discipline is as pronounced as on board ships of the royal navy. From February to July, when the ice is drifting with the Gulf Stream, the White Star vessels are navigated by a southerly track, and *vice versa* from August to January. When the ice has drifted and the northern parallels are clear of ice and fog, the boats take the northern track.

The average passages of the steamships of this line, both ways between Queenstown and New York, have been under nine days, and many passages have been under eight days. In July, 1875, the "Germania" made the passage from Queenstown to New York in seven days, twenty-three hours, seven minutes, and the return passage in August in seven days, twenty-two hours, eight minutes. The "Adriatic" and "Baltic" have also made passages under eight days, and in February, 1876, the "Germania" eclipsed herself and all other vessels of the line by steaming from Sandy Hook to Queenstown in seven days, fifteen hours, seventeen minutes, having traversed two thousand eight hundred and ninety-four knots, equal to 15.8 knots per hour for the entire passage. In 1877 the "Germania" made the passage in seven days, eleven hours, twenty-seven minutes. The "Britannia" made the passage in seven days, ten hours, fifty-three minutes.

An enthusiastic passenger in describing these vessels says of them,—

"In their internal arrangements the White Star ships were even more strikingly a 'new departure' in steamship architecture than in their model. The main saloon, instead of being at the stern, and hemmed in by state-rooms, making a long, narrow, badly-lighted apartment, is placed in the very middle of the vessel, and extends from side to side, forming a grand hall, seventy-five feet long and forty-five feet wide, lighted not only by the ample skylights, but by large windows at the

sides. A broad staircase, well lighted by night and day, leads to the saloon, where there is ample room for dining two hundred persons, giving to each diner his or her own seat, not of undefined capacity on a settee, but a chair with revolving seat, which is kept at every meal for the passenger to whom it is allotted at the commencement of the voyage, and can be approached at any time during the progress of the meals without disturbing the others. There is nothing to indicate that you are on shipboard; indeed, there is every appearance of hotel life of the most elegant and comfortable style, including even an open marble fireplace, which substitutes the customary stove, and gives an additional air of homeliness to the scene.

"The state-rooms are also arranged amidships, at either end of the saloon, and are large, well lighted, and furnished with every convenience, including electric bells. Bath-rooms are within easy reach, and nothing that can promote the comfort of the passenger is omitted. The smoking-room is not, as too often, a close little den, but a large and handsome apartment; and the ladies' saloon is on a more liberal scale than usual, and far more attractive in its appointments. From their situation and the great length of the ship, the main saloon, the state-rooms, and all the rooms for the general use of the passengers are almost entirely free from motion, except in the worst of weather, thus reducing the risk of sea-sickness to a minimum.

"Five water-tight bulk-heads run from the top to the bottom of the ship. These are supplemented by self-closing doors and other appliances designed to confine a leak or the effect of an accident to that part of the vessel to which the mishap may have occurred. These doors are perfectly self-acting and almost independent of human agency. In one compartment, containing the after-set of boilers, the door which leads to the next compartment is arranged for prompt water-tight closing. Should the water find its way into the neighboring compartment, the engineer in charge has only to turn a lever and the ponderous door falls into its place, regulated in its descent by an air cylinder which checks the door and causes it to fall in jerks. In another compartment the iron way upon which you walk is automatic. Should the sea find its way beneath, the door (for the flooring upon which you have passed is, after all, only a kind of iron bridge) rises by the action of the water, and confines the water to a section of the vessel. There is nothing more remarkable in the fittings of these steamers than these self-acting doors, which are always kept in perfect order, working with a simplicity only equaled by the importance of the work they can accomplish."

The managers of the line have adopted *ic* as the termination for the names of their vessels, as "Adriatic," "Celtic," "Baltic," "Britannic," "Germanic," "Republic," etc.

The following is a list of the steamers of the company that were engaged in the American trade in 1876, viz.:

	Tons.	Nom. H. P.	Saloon.
Britannic	5,004	760	200
Germanic	5,004	760	200
Celtic	3,888	650	150
Adriatic	3,888	650	150
Republic	3,707	600	140
Baltic	3,707	600	140
	25,198	4020	980

At a meeting of the passengers assembled in the saloon of the steamer "Britannic," lying off Sandy Hook, on the evening of August 17, 1877, on the completion of the voyage from Queenstown in the unprecedented time of seven days, ten hours, and fifty-three minutes, it was "*Resolved*, To ask Captain Thompson to accept a souvenir, suitably inscribed, to commemorate this achievement." The presentation took place in the saloon of the "Britannic." About thirty passengers and a number of invited guests were present. The souvenir consisted of a silver pitcher, with the following inscription: "Presented to Captain Wm. H. Thompson of S. S. 'Britannic,' by the passengers, to commemorate the voyage from Queenstown to New York, August 10 to August 17, 1877." The presentation speech was made by D. W. James, who humorously contrasted the discomforts of ocean travel twenty years ago with the speed and conveniences which modern vessels afford.

A silver cup, appropriately inscribed, was also presented to the chief engineer of the "Britannic," Thomas Sewell, as a mark of the passengers' appreciation of his skill and care during the voyage.

The "Coptic," the latest addition to the White Star Line, arrived at New York December 3, 1881, after an exceedingly rough passage of sixteen days. The "Coptic" is a sister-ship to the "Arabic," of the same line, and was built by Messrs. Harland & Wolfe, of Belfast, Ireland. The material used is milled steel, which was chosen on account of its great strength and toughness. Her dimensions are as follows: length, four hundred and thirty feet; breadth, forty-two feet; and depth of hold thirty-four feet. Her registered tonnage is four thousand three hundred and sixty-eight tons, but she will carry about six thousand. She is propelled by two double-cylindered compound engines of four hundred and fifty horse-power at ninety pounds pressure of steam. These were built by the Victoria Engine-Works, Liverpool. The main shaft is a built one. In the engine-room are the pumps, which are very large. In the next room are the two dynamos which furnish the electricity for the Swaim electric lights used throughout the ship. There are three double elliptical boilers, which require twelve fires to heat them, and have been tested to one hundred and eighty pounds. While

the "Coptic" is intended to be used more for carrying freight than passengers, the accommodations for passengers are very good. The state-rooms are large and supplied with all the conveniences known to modern ship-builders. The main saloon, which is handsomely upholstered in dark olive velvet, is approached through an entrance hall from the main staircase. The saloon is paneled in wood made to simulate embossed leather. The chairs are cane-seated and revolving. The light all through the ship is furnished by the Swaim electric lamps, which consist of carbonized threads inclosed in hermetically sealed glass bulbs. The hull of the "Coptic" is divided into eight compartments, either one of which might be stove in without endangering the vessel. The principle upon which the doors of these compartments are worked is comparatively new, and has been so highly approved by the English Admiralty Board that the government has adopted it in building vessels for the navy. The "Coptic" has four masts, three being square-rigged and the fourth being rigged fore-and-aft. There are three decks, braced in every direction, and turtle-backs forward and aft.

The "Coptic" left Queenstown on her first trip on the 17th of November, 1881. Her captain said of her, "She behaved very well. We had about as heavy weather as I have seen, and nothing could be more satisfactory than the 'Coptic.' When we were in about forty degrees west we were struck by a hurricane. On the 28th she was struck aft by a sea which stove in the after turtle-back over the rudder, swept everything loose away, stove in two boats, and carried two sailors overboard. We could do nothing to save them, because no boat could live in such a sea. The iron plates over the wheel were broken in. The stout iron rods were bent and twisted by the water as though they had been light wires in the hands of a strong man."

The chief engineer said of the engines, "They work beautifully. One man can, by moving six little levers, work the whole engine with one-half the effort ordinarily required to manage a small stationary engine. It works rapidly, too. On this side is the signal-plate which connects with the bridge. The engineer can in less than a minute after receiving the order stop, go ahead at full or half speed, or back. They are as easily managed as any engines I have ever seen. The new lights make the engine-room as light as day."

The "Coptic" and her sister-ship, the "Arabic," are intended for the carrying of freight and emigrants. The "Coptic" will probably be sent to the Pacific Ocean in two or three years, to run between San Francisco and Hong-Kong. She will carry more freight, and run faster on a given amount of coal, said her captain, than any vessel now running between New York and England. The "Coptic" on her first trip brought a few saloon passengers, three hundred emigrants, and a full cargo of freight.

THE COMPAGNIE GÉNÉRALE TRANSATLANTIQUE, 1862.—This company, established in 1862, maintains a regular line between Havre and New York. It receives a subsidy from the French government for its West India and New York and Havre lines; other independent services are not subsidized. In 1880 a contract was entered into between the company and the French government for its line between Marseilles, Algerian, and Tunisian ports, and a small subsidy granted.

The company has lately added to its lines a new weekly line from Marseilles to Genoa, Leghorn, Naples, Messina, Syracuse, Malta, etc.

The following table shows the fleet of the company, 1881:

FOR THE ATLANTIC.	Tonnage.	Horse-power.
Amérique	4500	900
France	4500	900
Labrador	4500	900
Canada	4500	900
Saint-Germain	3650	850
Pèreire	3300	900
Saint-Laurent	3400	900
Ville de Paris	3300	900
Lafayette	3400	800
Washington	3400	800
Olinde-Rodrigues	3000	660
Saint-Simon	3000	660
Ferdinand de Lesseps	3000	660
Ville de Marseille	3000	660
Ville de Bordeaux	2600	660
Ville de Brest	2600	660
Ville de Saint-Nazaire	2600	660
Colombie	2800	660
Caldera	2800	660
Salvador	900	250
Saint-Domingue	800	250
Venezuela	800	250
Alice	800	100
Caravelle	700	250
Colomba	600	200
Caraïbe	600	125
TUG.		
Belle Isle	150	100
TRANSPORT STEAMERS.		
Bixio	2280	250
Flachat	2280	250
Le Chatelier	2227	250
Fournel	2000	250
Clapeyron	1760	180
Provincia	1700	180
Martinique	1600	200
Picardie	1500	200

FOR THE MEDITERRANEAN.	Tonnage.	Horse-power.
Moïse	1800	450
Saint-Augustin	1800	450
Isaac Péreire	1800	450
Abd-el-Kader	1800	450
Charles-Quint	1800	450
Ville de Madrid	1800	450
Ville de Barcelone	1800	450
Kléber	1800	450
Ville d'Oran	1800	450
Ville de Bone	1800	450
Afrique	800	250
Ajaccio	800	250
Bastia	800	250
Corse	800	250
Immaculée-Conception	800	250
Lou-Cettori	800	250
Maréchal Canrobert	800	250
Mohammed-el-Sadeck	800	250
Malvina	800	250
Manoubia	600	200
Ville de Tanger	600	200
Dragut	500	150
Mustapha-ben-Ismaïl	500	150
La Vallete	500	150
Insulaire	400	150
RESERVES.		
Guadeloupe	1600	400
Désirade	1400	400
SHIPS BUILDING.		
Ville de Rome	1800	450
Ville de Naples	1800	450
Ville de New York.		

The "Ville de New York," now in course of construction at

Barrow-in-Furness for the General Transatlantic Company, is to be the largest steamship that has entered the port of Havre. According to the plans her length between perpendiculars will be four hundred and sixty feet; depth of hold, from bottom of keel to spar-deck, thirty-seven feet six inches. Her beam is to be proportioned with her draught, which cannot exceed twenty-three feet in depth on account of the bar or entrance on the river Seine, and its breadth is to be fifty feet. In her length she is to be divided into ten water-tight compartments, two of which will be occupied by the boilers, which can be separated in case of emergency. One-half of the boiler-power can be used without stopping the vessel, and will give a speed of almost eleven knots. A water-tight bottom, which is to extend her whole length, can also be used for ballasting the vessel and giving her uniform draught, and a system of pumps worked by steam will insure her speedy and adequate drainage. The "Ville de New York" will have four masts and two smoke-stacks. She will have all the latest improvements and most recently devised accommodations.

There are to be four decks and a promenade-deck extending alongside on top of the main deck, and supported forward by stanchions. This one will be entirely reserved for the first- and second-class passengers. No sailors will be permitted on it, as all their work will be done on the deck below, which is also to be used by the third-class passengers. Forward and aft on the promenade-deck there are to be two turrets, which will contain the signal-fire and the double foot-bridge for the officers on watch. The pilot-house, which is to be fitted with steam steering-gear, and the captain's house, will be located here too. The arrangements for the crew will be such that every department will do its work without interfering with the passengers. The officers' rooms will be situated forward under cover, so as to be convenient to the bridge, where they have to be on watch, and the engineers' berths are to be arranged around the engine-room, so that they may not be obliged to go on deck.

The first-class passengers' saloon and cabins will be in the centre of the vessel, forward of the machinery, where the pitching is felt least. Twenty-four of the cabins will contain single berths, and have skylights for admitting air in all weathers. All will be lighted by means of electricity. The second-class passengers are to be located aft of the machinery, and third-class at the end of the first-class cabins, between decks. Splendidly furnished dining-rooms, saloons, and reading-rooms will form one of the vessel's attractions, and there will be a system of baths and all arrangements likely to contribute to comfort.

The machinery will be compound, with cylinders set one above the other. Each of the three compound engines will have its own crank-shaft and condenser. The air and circulating pumps will be independent. The six cylinders will have a stroke of five feet seven inches.

The diameter of high-pressure cylinders will be thirty-five and one-half inches, and that of the low-pressure cylinders seventy-five inches. The whole condensing surface will be ten thousand three hundred feet, and every one of the circulating pumps will be able to supply at full speed two hundred and fifty gallons of water per second.

The boilers supplying the steam to the main engine will have in all thirty-six furnaces, with a fire surface of twenty-one thousand six hundred square feet; besides there will be a large donkey boiler, with two furnaces having five hundred and fifty square feet of fire surface, for supplying steam to the hoisting-engines, donkey-pumps, and other steam apparatus. The main boilers will carry a steam-pressure of ninety pounds per square inch, and the power of the engines, it is claimed, can be estimated at seven thousand horse-power on trial, giving a speed of sixteen and one-half knots.

THE WILLIAMS & GUION LINE, 1866.—This line was established in August, 1866. It was formerly the Black Star Line of packet-ships, which were run from Liverpool to New York for twenty-four years, carrying some sixty thousand passengers yearly, and never losing a ship or a life by accident. From 1866, when the steamship line was established, up to 1873 the line ran six steamers, each making eight round trips per year, carrying, on an average, six hundred passengers to New York and one hundred from New York each trip, making seven hundred passengers per round trip, or a total per year of thirty-three thousand six hundred, and a grand total of passengers carried between 1866 and 1873 of fully two hundred and fifty thousand. In January, 1868, the "Chicago," of this line, ran ashore near Queenstown and became a total wreck, all hands being saved. Since then the "Colorado" was run into in the Mersey, and six passengers jumped overboard and were drowned. All the others were saved.

In August, 1866, the iron screw steamer "Manhattan" sailed from Liverpool for New York, being the pioneer of their new fleet. The "Minnesota," "Nebraska," "Colorado," "Idaho," "Nevada," "Wisconsin," and "Wyoming," named for the States and Territories of the Union, each of about three thousand tons, and built of iron specially for this line, followed in rapid succession. In 1873 the "Montana," of three thousand five hundred tons, was added, and in 1874 the "Dakota," a sister-ship. The incorporate name of the company is the "Liverpool and Great Western Steamship Company," but it is best known as the *Guion* Line.

The "Alaska," the latest addition to the Guion Line, arrived in New York on her first trip, after a prolonged and stormy passage, on the afternoon of November —, having left Queenstown, Tuesday, November 1, during a severe storm, which during the night turned into a complete hurricane. The steam steering-gear gave way, as also did the hand-gear, which compelled a stop for ten hours to repair the damage. The

next day a small steam-pipe broke, which filled the engine-room with steam and obliged the engineers to leave their posts and put out the fires. It was only a water-pipe used to lessen the noise of escaping steam, but it caused great inconvenience and obliged them to work up to sixty-five pounds of steam only, when the vessel is capable of working under one hundred. An average of sixteen knots an hour was made, but it is expected the "Alaska" will make regularly eighteen and one-half knots an hour and record four hundred and forty miles a day. She made four hundred and two miles one day with only sixty-five pounds of steam.

As the vessel lay at anchor in the stream she presented a fine appearance, but only when on board of her could one get an idea of her size. The principal dimensions of the "Alaska" are as follows: length, five hundred and twenty-six feet; breadth, fifty feet six inches; depth, forty feet seven inches to upper deck, or forty-eight feet seven inches to promenade-deck. Her gross tonnage is about eight thousand tons. The engines are of the compound inverted, direct-acting three-cylinder type. The high-pressure cylinder sixty-eight-inch diameter, and the two-ton pressure cylinders one hundred inches diameter each, with a stroke of six feet. Steam is supplied by boilers of the usual cylindrical form at a pressure of one hundred pounds. The indicated horse-power is about one thousand. The "Alaska" has two smoke-stacks and four masts, bark-rigged. There are altogether seven decks. The first, or promenade-deck, extends the whole length and breadth of the vessel, excepting the parts in the bow and stern forming the "turtle." The second deck is an open one along the sides of the vessel, and along the middle are the quarters for the officers and engineers and a number of state-rooms for intermediate passengers. In the third or main deck accommodations are provided for three hundred and forty first-class, sixty second-class, and one hundred and eighteen steerage passengers. This deck, amidships, is taken up entirely by the state-rooms and dining-saloons for first-class passengers. The entrance to the main saloon is by a spacious stairway from the second deck, and is handsomely arranged. The main saloon itself is fifty feet wide and sixty-four feet long, and has a seating capacity for two hundred and eighty people. The ceiling is nine feet high ordinarily, but a spacious cupola of stained glass twenty-three feet long and fifteen feet wide makes the centre of the main saloon twenty feet high. The sides of the saloon are finished in hard woods, with panels of maple, teak, satin, and oak inlaid. The upholstery is in blue Utrecht velvet. Near the saloon is the ladies' cabin, upholstered with rich brocaded tapestry, with sofas well arranged for comfort and ease. Communicating with this room are the ladies' bath-rooms, which are complete in every particular. The main saloon and smoking-room is twenty-eight feet wide and twenty-four feet long. It is floored in parquetry prettily designed.

There are four bath-rooms on the main deck, as well as lavatories at convenient places. The fourth deck is almost entirely devoted to steerage passengers, and will accommodate one thousand persons. The fifth deck is used entirely for cargo. The "Alaska" is fitted with steam-windlass, steam steering-gear, steam-winches, and all the most improved appliances for navigation and for promoting the comfort of the passengers. There are electric bells communicating with the chief steward's office throughout the ship, and she is fitted with Swan's electric lights.

THE LEYLAND LINE.—This line has a large fleet, all of which, except the Boston steamships, run to Mediterranean ports, for which there are four departures a week. The steamers of this line bear names ending with the letter "n," and have the further peculiarity of being ranged in classes according to the letters with which their names begin, the names of sister-ships always beginning with the same letter. Thus, the steamers of the Boston service are always spoken of as the "B's" and the "I's,"—the "Bavarian," "Batavian," "Bohemian," and the "Istrien," "Illyrien," and "Iberien."

The "Flavian," repaired in Boston, replaced the "Bohemian," lost, in the Boston service of the company. The disaster which overtook her caused the giving up a projected line to Baltimore. She is different from the regular boats of the line running to Boston, being much smaller and shorter than the large four-masters, is of lighter draught, and of greater beam in proportion to her length, which is three hundred and thirty-five feet. She has but two masts. Her tonnage is about fourteen hundred by measurement. She is finely fitted up, and has comfortable quarters for officers and crew. She was built at Jarrow-on-Tyne, a name hardly known this side of the Atlantic, but which has the greatest iron ship-building yard in the world. It employs seven thousand men, and everything is done on the premises. The iron is taken from the company's mines three miles up the river, enters the yard as crude ore, and leaves it a complete steamship. The coal is mined in the yard. At Jarrow there are now three monster steamers building specially for the Boston service of the Leyland Line, and they will probably begin running in the autumn of 1882. Two of them are called the "Virginian" and the "Valencian," the third will also have a name beginning with V. The three "V's" will be steamers of about five thousand tons and about five hundred feet long, much larger than any of the present boats, but resembling them in build.

The flag of the Leyland Line is red, and the funnels of the vessels are painted flesh color with a black curved top. The night-lights are three red lights shown in succession.

The steamer "Bohemian," mentioned above, was wrecked in Dunlough Bay, February 6, 1881. She sailed from Boston on January 27, 1881, for Liverpool, and went ashore on the Irish coast during a

dreadful storm. Of those on board thirty-two were drowned, and twenty-one of the crew, including the second officer, were saved. Another survivor was seen on a rock, separated from the mainland. All efforts to rescue him failed. Two life-boats were capsized in the attempt.

The "Bohemian" was about fifteen years old, and had been on the Leyland Line for five years.

CITY LINE OF OCEAN STEAMSHIPS.—The steamships of this line, sailing fortnightly *via* the Suez Canal from Glasgow and Liverpool to Calcutta direct and back to London, are so called because they are all named for the principal cities of the world. They are owned by Messrs. George Smith & Sons, of Glasgow, and comprise twelve steamships, varying in tonnage from three thousand seven hundred and fifty to two thousand three hundred and twenty-eight tons, viz.:

City of Damascus	3750 tons.	City of Cambridge	2329 tons.
City of Agra	3412 "	City of Edinburgh	3212 "
City of London	3212 "	City of Canterbury	3212 "
City of Khios	3246 "	City of Carthage	2650 "
City of Venice	3206 "	City of Mecca	2290 "
City of Manchester	3125 "	City of Oxford	2328 "

Total tonnage of the fleet, 35,972.

1871.—THE AMERICAN STEAMSHIP COMPANY OF PHILADELPHIA was organized in 1871 with a capital of two million five hundred thousand dollars, and a contract was given to Messrs. Cramp & Sons, of Philadelphia, for the construction of four first-class iron steamships of three thousand tons burden, and to have an average speed of thirteen knots an hour. The steamers were intended to carry the mails and conduct a general freight and passenger business between Philadelphia and Liverpool, calling at Queenstown. The "Pennsylvania," the pioneer steamship of the line, was launched in August, 1872, and made her first voyage in May, 1873. The "Ohio," "Indiana," and "Illinois" followed at regular intervals. They are three hundred and sixty feet long, forty-two feet beam, and thirty-three feet depth of hold. Their engines are nominally five hundred horse-power, and capable of being worked up to three thousand. Their great breadth of beam, in proportion to their length, tends to increase their steadiness at sea. This line is now the only transatlantic line sailing under the American flag, and the fleet in 1881 embraced the following nine first-class steamships:

Pennsylvania	3104 tons.	Lord Gough	3655 tons.
Ohio	3104 "	British Crown	3487 "
Indiana	3104 "	British Queen	3558 "
Illinois	3104 "	British King	3558 "
Lord Clive	3886 "	British Prince	3858 "

A steamer of the fleet sails every Wednesday and Saturday between

Liverpool and Philadelphia from each port, calling at Queenstown. They are capable of carrying one hundred first-class, seventy-five intermediate, and eight hundred steerage passengers, with from three thousand five hundred to four thousand five hundred tons of freight. A portion of the main deck is set apart for the special accommodation of "intermediate" passengers. Families can secure separate rooms, and have their meals served apart from the other passengers, at about half the price paid by holders of first-class tickets, and the bill of fare is ample and varied. The accommodations for steerage passengers are excellent, and great pains is taken to secure comfort and to provide wholesome and unstinted food for this class of voyagers.

The company flag is a white keystone on a red field. The smoke-stacks are painted red with a black rim around the top, and have a white keystone painted on each side. The largest vessel of the line, the "British Prince," is four hundred and nineteen feet long, has forty-two feet beam and twenty-eight feet depth of hold, and is three thousand eight hundred and fifty-nine tons register.

The shortest passage made by any steamer of the line was made by the "Illinois," October, 1880, from Queenstown to Cape Henlopen, in eight days, ten hours, and thirty-four minutes,—thus beating the "Pennsylvania's" shortest time of eight days, nineteen hours, and twelve minutes. The average passage is about ten days. The "Illinois," in her fifty-nine round voyages, or one hundred and eighteen passages, has had six years, ten months, and thirteen days sea service. In the fifty-nine passages out to Queenstown she traveled one hundred and seventy-three thousand miles, and in the fifty-nine home to Henlopen, one hundred and seventy-one thousand and ninety-two miles, a total distance of three hundred and forty-four thousand and ninety-two miles, to which must be added ten thousand six hundred and twenty miles up and down the Delaware and twenty-seven thousand nine hundred and sixty-six miles from Queenstown to Liverpool, making the total nautical miles three hundred and eighty-two thousand six hundred and seventy-eight, equal to four hundred and forty-one thousand and ninety-three statute miles.

Safeguards against loss of life at sea constitute a feature in the equipments of these steamers. Each, in addition to the usual complement of life-boats of the ordinary construction, carries a number of life-rafts, provided with bread- and water-tanks, kept constantly supplied. These rafts can be thrown into the water with scarcely a moment's delay; and having appliances for the accommodation of passengers on both top and bottom, are always right side up. They are far more available in a storm than ordinary life-boats, which have to be lowered with great caution, and are not unfrequently stove against the side of the ship and rendered useless.

It was in one of these steamers, the "Indiana," that General Grant,

on the 17th of May, 1877, took his departure from Philadelphia on starting upon his trip around the world.

This enterprise has achieved success without aid from the government, and has demonstrated the possibility of running a splendid line of European steamers without the assistance of a government subsidy.

The five latest additions to the line were built in Great Britain, two being constructed by Harland & Wolff, of Belfast, and three by the Lairds, of Liverpool. Although of greater tonnage, they are not fitted to carry as many *first*-class passengers as the American-built ships.

STEAM FERRY-BOATS IN NEW YORK HARBOR—1810–14.—In 1810 arrangements were made with Robert Fulton to construct steam ferry-boats, and on the 2d of July, 1812, one named the "Jersey" was put in operation between Paulus Hook, Jersey City, and New York. The event was celebrated with a grand banquet given by the Jerseymen to the New York Common Council. A correspondent to a newspaper of the time says,—

"I crossed the North River yesterday in the steamboat, with my family in my carriage without alighting therefrom, in fourteen minutes, with an immense crowd of passengers. On both shores were thousands of people viewing the pleasing object. I cannot express to you how much the public mind appeared to be gratified at finding so large and so safe a machine going so well."

This "large machine" was eighty feet long and thirty feet wide.

A year later the "York" was put on with the "Jersey." They were supposed to run every half-hour from sunrise until sunset, but frequently an hour was consumed in making a trip. Fulton's description of one of the boats is as follows:

"She is built of two boats, each ten feet beam, eighty feet long, and five feet deep in the hold; which boats are distant from each other ten feet, confined by strong transverse beam-knees and diagonal traces, forming a deck thirty feet wide and eighty feet long. The propelling water-wheel is placed between the boats to prevent it from injury from ice and shocks on entering or approaching the dock. The whole of the machinery being placed between the two boats, leaves ten feet on the deck of each boat for carriages, horses, and cattle, etc.; the other, having neat benches and covered with an awning, is for passengers, and there is also a passage and stairway to a neat cabin, which is fifty feet long and five feet clear from the floor to the beams, furnished with benches, and provided with a stove in winter. Although the two boats and space between them give thirty feet beam, yet they present sharp bows to the water, and have only the resistance in the water of one boat of twenty feet beam. Both ends being alike, and each having a rudder, she never puts about."

The Legislature of New York passed an act March 4, 1814, allowing William Cutting and others to run a steam ferry with passengers at

four cents each between Brooklyn and New York. The first trips were made in the beginning of May, 1814, and the name of the boat was the "Nassau." The *Columbian*, a newspaper of that time, contained an account of the new ferry, and stated that on one of the first trips of the "Nassau," from the Beekman slip to the lower ferry in Brooklyn, there were five hundred and forty-nine passengers, one wagon and a pair of horses, two horses and chaise, and one single horse. The trip occupied from four to eight minutes, and forty crossings were made every day.

The veteran artist Banvard, in an interview with a reporter, December, 1881, says, "I crossed this Fulton Ferry from Fair, now Fulton, Street on this first steam ferry-boat. At that time the boilers were placed on deck, and Fulton Street was a country road with old farm-houses on either side."

Surmounted by a picture of the steamboat, an advertisement of the ferry company of 1814 reads:

"*New York and Brooklyn Ferry.*

"SUCH persons as are inclined to compound agreeable to law, in the Steam Ferry Boat, Barges, or common Horse boats, will be pleased to apply to the subscribers, who are authorized to settle the same.

"GEORGE HICKS, Brooklyn.
"JOHN PINTARD, 52 Wall st.

"Commutation for a single person not transferable for	12 months	$10 00
Do Do	8 months	6 67
"May 8, 1814.		6 m."

Fulton and Cutting formed a company, "The New York and Brooklyn Steamboat Ferry Association," with a capital of sixty-eight thousand dollars, in sixty shares, valued at one thousand three hundred and thirty-three dollars and thirty-three cents each. The first steamboat of this company was the "Nassau," and the Long Island *Star* of May 14, 1814, mentions her *first* trip. The boat must have been adapted for the work, as it is stated "Her trips varied from five to twelve minutes; carriages and wagons, however crowded, pass on and off the boat with the same facility as in passing a bridge."

Some time after the steamboat, supplementary scows were run by horses. These scows had double hulls, and with the paddle in the middle. Eight horses supplied the power.

In 1817 the advantages of the steamboat were so manifest that the public were clamorous for a second boat, which, according to the agreement, was to be placed on the route by May 1, 1819. The company demurred on the ground of expense, and alleged that teamboats were more easily navigated and much safer in winter than steamboats. They offered to substitute the horse for the steam on the boat, and to run it until 8 P.M. The New York authorities, with reluctance

and in order to avoid legislative interference, agreed, and the price was raised to four cents for both team- and steamboats. In 1833, David Leavitt and Silas Butler, having bought forty-four of the sixty shares of the Fulton Ferry stock, obtained control of the ferry and put on two new boats.

Mr. Banvard has recorded his reminiscences of the old horse ferry-boat from New York to Brooklyn in verse:

"How well I remember the horse-boat that paddled
'Cross the East River ere the advent of steam:
Sometimes the old driver the horses would straddle,
And sometimes ride round on the circling beam.

"The old wheel would creak, and the driver would whistle
To force the blind horses to pull the wheel round;
And their backs were all scarr'd and stuck out in bristles,
For the driver's fierce stick their old bones would pound.

"The man at the gate, in fair weather or rainy,
Stood out in the storm by the cold river-side,
With pockets capacious, to hold all the pennies:
It took just four coppers to cross o'er the tide.

"The pilot, he, too, took the wind and the weather,
Perched o'er the horses, with his tiller in hand;
Sometimes would the wind and the tide fierce together
Delay him in getting his boat to the land.

"Tho' four-horse was the power that plowed the fierce river,
Yet oft in his hurry would the passenger curse,
Though no thought would come to make a man shiver
About the dread danger of a boiler to burst."

1811.—On the 29th of November, 1811, Daniel Dod, a citizen of the United States, was granted a United States patent, by which he claimed as his inventions,—

1st. The construction of the boiler.

2d. The condenser, consisting . . .

3d. The exclusive right to place the steam cylinder and other parts of the steam-engine between two boilers in a steamboat as described.

4th. The disposition and arrangement of the several parts and combination of the whole machinery.

In an accompanying schedule Dod says, "I make the steam-engine to work with a double impulse, on the general principles of Watt and Bolton's steam-engines. I form the condenser of a pipe or a number of pipes condensed together, and condense the steam by immersing the pipes in cold water, either with or without an injection of water. For propelling a boat I make use of two wheels, one on each side, hung on an axis which lies across the boat. In the middle of this axis is a crank to which is attached the lower end of a pitman. The upper end of the pitman is attached to one end of a lever-beam; the main piston-

rod is attached. The lever-beam is placed above the cylinder of the steam-engine, in the manner practiced by Watt and Bolton.

"The fly-wheels of the steam-engine I fix on the axis of the propelling wheels; I make the fly-wheels by weighting the propelling wheels with iron buckets or propelling boards, or with iron segments.

"For steam I use two boilers placed in the bottom of the boat, one on each side of the space allotted for machinery. I fix the cylinder and steam-engine between the boilers.

"The boilers I construct, viz.: the outside to be a cylinder of a length and diameter to produce the required steam. The cylinder to be horizontal, with a fixed flue equal to its length; its form the segment of a semicircle or greater. This flue, placed within and near the lower side of the cylinder, allowed space for the water to pass under it. Within the flue, at one end, was the fire; at the opposite end a pipe for carrying off the smoke and producing a draught to carry off the smoke and make the fire burn briskly. The flat or upper side was strengthened and supported by perpendicular tubes, and by rods and braces extending from the upper side of the flue to the upper side of the cylinder. The axes of the propelling wheels pass over the top of the boilers."

1812.—May 12, 1812, Daniel Dod obtained another patent for his mode of applying the steam-engine to boats, mills, etc. After specifying his invention, Dod says, "My mode of applying this invention to the navigation of a boat is as follows:

"I place two propelling wheels as near the bow of the boat as convenience will admit. The arbors of these two wheels are placed in the same right line, and the inner ends of the arbors approach near together in the middle of the boat. One crank attached to the end of both arbors, and one pitman from the end of the lower beam, put both wheels in motion.

"Then two other propelling wheels are placed so far abaft of the forward wheels that the distance shall be equal to the sum of the length of the two lever-beams. The arbors of these two abaft wheels also are placed in a right line with each other, and the inner ends of the arbors approach near together, and a crank is connected with the ends of both arbors, similar to the forward wheels. Then a pitman from the end of the other lever-beam will drive both wheels together.

"In this way, without a cog-wheel or sector of any kind, I employ one steam-engine and a boat to drive *four propelling wheels*, by which means I am enabled to avail myself of a large proportion of propellers, without making my wheels so wide as to project out an inconvenient distance from the sides of the boat."

Dod claimed the driving of double sets of machinery with one steam-engine, and the applying of four propelling wheels to a boat, as his invention and exclusive right; but no profitable result seems to have been achieved from his invention.

INTRODUCTION OF STEAMBOATS ON THE WESTERN WATERS.—*The First Trip of the "New Orleans" from Pittsburg to New Orleans.*[n]—1811. —Prior to the introduction of steamboats on the Western waters the means of transportation thereon consisted of keel-boats, barges, and flat-boats. The two former ascended as well as descended the stream. The flat-boat or "broad horn," an unwieldy box, was broken up for its lumber on arrival at its place of destination. Whether steam could be employed on the Western rivers was a question that its success between New York and Albany was not regarded as having entirely solved, and after the idea had been suggested of building a boat at Pittsburg to ply between Natchez and New Orleans, it was considered necessary that investigations should be made as to the currents of the rivers to be navigated. These investigations were undertaken by Mr. Nicholas J. Roosevelt, with the understanding that if the report was favorable Chancellor Livingston, Mr. Robert Fulton, and himself were to be equally interested in the undertaking. Livingston and Fulton were to supply the capital, and Roosevelt was to superintend the building of the boat and engine. He accordingly repaired to Pittsburg in May, 1809, accompanied by his bride, where he built a flat-boat which was to contain all the necessary comforts to float himself and wife with the current from Pittsburg to New Orleans, and this boat was the home of the young couple for six months. He reached New Orleans about December 1, 1809, and returned thence to New York in the first vessel. Mr. Roosevelt had made up his mind that steam was to do the work, and his visit was to ascertain how best it could be done upon the Western streams. He gauged them and measured their velocity at different seasons, and obtained all the statistical information within his reach. Finding coal on the banks of the Ohio, he purchased and opened mines of that mineral, and so confident was he of the success of his steam project that he caused supplies of the fuel to be heaped up on the shore in anticipation of the wants of a steamboat whose keel had yet to be laid, and whose existence was dependent upon the impression of his report upon capitalists, without whose aid the plan would have to be, temporarily at least, abandoned. Mr. Roosevelt's report so impressed Fulton and Livingston, that in the spring of 1810 he returned to Pittsburg to superintend the building of the first steamboat that was launched on the Western waters. On the Alleghany side, close by the creek, and immediately under a bluff called Boyd's Hill, the keel of Mr.

[n] This account of the "New Orleans'" first voyage is condensed from "The First Steamboat Voyage on the Western Waters," by J. H. B. Latrobe, Baltimore, October, 1871, 32 pp., 8vo, Fund Publication, No. 6, of the Maryland Historical Society. Mrs. Roosevelt was a sister of Mr. Latrobe, and alive when he wrote his narrative. This successful voyage of the "New Orleans" down the Ohio and Mississippi antedates the first voyage of the "Comet" on the Clyde, which commenced to ply between Glasgow and Helensburgh January, 1812, with only a speed of five miles an hour.

Roosevelt's vessel was laid. The depot of the Pittsburg and Connellsville Railroad now occupies the ground (1880). The size and plan of this steamboat had been furnished by Mr. Fulton. It was to be one hundred and sixteen feet in length, with twenty feet beam. The engine was to have a thirty-four-inch cylinder, and the boiler, etc., to be in proportion. To obtain the timber, men were sent into the forest to find the ribs, knees, and beams, transport them to the Monongahela, and raft them to the ship-yard. The ship-builders and mechanics for the machinery department had to be brought from New York. A rise in the waters of the Monongahela set all the buoyant materials afloat, and at one time it seemed probable that the vessel would be lifted from its ways and launched before its time. At length the boat was launched, at a cost of near thirty-eight thousand dollars, and named "New Orleans," from the place of her ultimate destination.

As the "New Orleans" approached completion and it became known that Mrs. Roosevelt intended to accompany her husband, she was dissuaded from the utter folly if not absolute madness of the voyage. Her husband was told he had no right to peril her life, however reckless he might be of his own. The wife, however, believed in her husband, and after a short experimental trip in the latter part of September, the "New Orleans" commenced her voyage. There were two cabins, one aft for ladies and a larger one forward for gentlemen. In the former were four berths. Of this Mr. and Mrs. Roosevelt took possession, as they were the only passengers. There was a captain, an engineer named Baker, Andrew Jark the pilot, six hands, two female servants, a man waiter, a cook, and an immense Newfoundland dog, "Tiger." Thus equipped, the "New Orleans" began the voyage which changed the relations of the West, and which may almost be said to have changed its destiny.

The people of Pittsburg turned out *en masse* and lined the banks of the Monongahela to witness the departure of the steamboat, and shout after shout rent the air, and handkerchiefs were waved, and hats thrown up by way of "Godspeed" as the anchor was raised, and as she disappeared behind the first headlands on the right bank of the Ohio.

Too much excited to sleep, Mr. Roosevelt and his wife passed the greater part of the first night on deck, and watched the shore, covered then with an almost unbroken forest, as reach after reach and bend after bend were passed at a speed of from eight to ten miles an hour.

On the second night after leaving Pittsburg the "New Orleans" rounded to opposite Cincinnati and cast anchor in the stream. Levees and wharf-boats were things unknown in 1811. Here as in Pittsburg the whole town seemed to have assembled on the bank, and many of the acquaintances of the former visit came off in small boats. "Well, you are as good as your word; you have visited us in a steamboat," they said; "but we see you for the last time: your boat may go *down*

the river, but as to coming up it, the idea is an absurd one." The keel-boatmen shook their heads as they crowded around the strange visitor and bandied river wit with the crew that had been selected from their own calling for the first voyage. Some flat-boatmen, whose arks the steamboat had passed a short distance above the town, and who now floated by with the current, seemed to have a better opinion of the new-comer, and proposed a tow in case they were again overtaken. But as to the boat's returning all agreed that *that* could never be.

The stay at Cincinnati was brief, only long enough to take in a supply of wood for the voyage to Louisville, which was reached on the night of the fourth day after leaving Pittsburg. It was midnight on the 1st of October, 1811, that the "New Orleans" dropped anchor opposite the town. There was a brilliant moon. It was as light as day almost, and no one on board had retired. The roar of the escaping steam, then heard for the first time, roused the population, and, late as it was, crowds came rushing to the bank of the river to learn the cause of the unwonted uproar. A letter written by one on board records the fact that there were those who insisted that the comet of 1811 had fallen into the Ohio and produced the hubbub!

A public dinner was given Mr. Roosevelt a few days after his arrival, complimentary toasts were drunk, and the success of the steamboat in navigating down-stream was acknowledged, but her return up-stream was deemed impossible, and it was regretted that it was the first and last time a steamboat would be seen above the falls of the Ohio.

Not to be outdone in hospitality Mr. Roosevelt invited his hosts to dine on board the "New Orleans," which still lay anchored opposite the town. The company met in the forward or gentlemen's cabin, and the feast was at its height when suddenly there were heard unwonted rumblings, accompanied by a very perceptible motion in the vessel. The company had but one idea: the "New Orleans" had escaped from her anchor, and was drifting towards the falls, to the certain destruction of all on board. There was an instant rush to the upper deck, where the company found that instead of drifting towards the falls of the Ohio the "New Orleans" was making good headway up the river, and would soon leave Louisville in the distance down-stream. As the engine warmed to its work and the steam blew off at the safety-valve, the speed increased. Mr. Roosevelt had, of course, provided this mode of convincing his incredulous guests, and their surprise and delight may be readily imagined. After going up the river a few miles the "New Orleans" returned to her anchorage.

On leaving Pittsburg it was intended to proceed as rapidly as possible to New Orleans to place the boat on the route for which it was designed, between that city and Natchez. It was found, however, on reaching Louisville there was not a sufficient depth of water on the falls of the Ohio to permit the vessel to pass over them in safety. The

"New Orleans" therefore returned to Cincinnati, convincing the most incredulous of her power to stem the current of the river. The waters having risen, the "New Orleans" returned to Louisville, and safely passed through the rapids, crowds collecting to witness her departure. "Instinctively each one on board grasped the nearest object, and with bated breath awaited the result. Black ledges of rock appeared only to disappear as the 'New Orleans' flashed by them. The waters whirled and eddied and threw their spray upon the deck, as a more rapid descent caused the vessel to pitch forward to what at times seemed certain destruction. Not a word was spoken. The pilots directed the men at the helm by motions of their hands. Even the great Newfoundland dog seemed affected by the apprehension of danger, and crouched at Mrs. Roosevelt's feet. The tension on the nervous system was too great to be long sustained. Fortunately, the passage was soon made, and the 'New Orleans' rounded to in safety below the falls."

Hitherto the voyage had been one of exclusive pleasure, but now were to come, in the words of the letter referred to, "those days of horror." The comet had disappeared, and was followed by the earthquake of that year, which accompanied the "New Orleans" far on her way down the Mississippi, the first shock of which was felt while she lay at anchor after passing the falls. On one occasion a large canoe fully manned came out of the woods abreast of the steamboat and paddled after it. There was at once a race, but steam had the advantage of endurance, and the Indians with wild shouts soon gave up the pursuit. One night there was an alarm of fire. The servant had placed some green wood too close to the stove in the forward cabin, which caught fire and communicated to the joiner-work of the cabin, when the servant, half suffocated, rushed on deck and gave the alarm. By dint of great exertion the fire was extinguished. At New Madrid, a greater portion of which had been engulfed, terror-stricken people begged to be taken on board, while others dreading the steamboat more than the earthquake hid themselves as she approached. Having an insufficient supply of provisions for any large increase of passengers, the requests to be taken on board had to be denied. The earthquake had so changed the channels of the river that the pilots became confused, and guided her course more by luck and judgment than knowledge. As the steamboat passed out of the region of the earthquake the principal inconvenience was the number of shoals, snags, and sawyers. These were safely passed, however, and the vessel came in sight of Natchez and rounded to opposite the landing-place. Expecting to remain here for a day or two the engineer had allowed his fires to go down, so that when the boat turned its head up-stream it lost headway altogether, and was being carried down by the current far below the intended landing. Thousands were assembled on the bluff and at the foot of it, and for a moment it would have seemed that the "New

Orleans" had achieved what she had done so far only that she might be overcome at last. Fresh fuel, however, was added; the engine was stopped that steam might accumulate; presently the safety-valve lifted, a few turns of the wheels steadied the boat, a few more gave her headway, and overcoming the Mississippi, she gained the shore amid shouts of exultation and applause.

From Natchez to New Orleans there was no occurrence worthy of note. "Although forming no part of the story of the voyage proper," says Mr. Latrobe, "yet as this has been called a romance, and all romances end, or should end, in a marriage, the incident was not wanting here, for the captain of the boat falling in love with Mrs. Roosevelt's maid, prosecuted his suit so successfully as to find himself an accepted lover when the 'New Orleans' reached Natchez; and a clergyman being sent for, a wedding marked the arrival of the boat at the chief city of the Mississippi."

The "New Orleans" ran afterwards between that city and Natchez. The first steamboat that ever ascended the streams of the Mississippi and Ohio was the fourth one launched on the Ohio and the second built at Brownsville, and was named the "Enterprise." She was of only seventy-five tons burden. In 1814 she descended to New Orleans, and after serving General Jackson in his defense of that city in 1815, undertook and completed the return voyage to Pittsburg, reaching Louisville in twenty-five days. The waters of the Mississippi at the time were high, and consequently she was enabled to avoid the current where any existed, and made her way through "cut-offs" and over inundated fields in still water. The voyage of the "Enterprise," as is usually the case with first experiments, failed to convince the public of the practicability of ascending the Mississippi when that river was confined within its banks and its current sweeping downward at a rate due to a descent of four inches to the mile. It was reserved to the steamboat "Washington," Captain Shreve, to demonstrate by a second voyage of twenty-five days from New Orleans to Louisville that steamboats could ascend this river in at least one-fourth the time required by the barges and keel-boats hitherto in exclusive use. At a public dinner given to Captain Shreve at Louisville on his return, he predicted that the time would come when his twenty-five-day voyage would be made in *ten*,—a feat which his audience no doubt considered visionary, but which has since been performed in *four days* and *nine* hours.

The oldest steamboat company in the United States or in the world in 1858 (and we believe it still exists) was the United States Mail Line between Cincinnati, Louisville, and St. Louis. It was organized in 1818, and kept improving and adding to its boats. This company built the first steamer designed *exclusively* for passengers. She was named the "General Pike," and made her trips between Louisville and Cincinnati in thirty-one hours,—a passage now made in nine hours.

In 1858 eighteen miles an hour was the maximum speed attained on Western waters. At that date eight hundred and sixteen steamboats were employed on the Mississippi and its tributaries, having a total tonnage of 326,443 tons, besides two thousand three hundred barges and flat-boats. The traveler now on the Father of Waters is seldom if ever out of sight of the smoke or sound of a steamboat, and the boats have increased in size from seventy-five tons to between one and two thousand tons, with machinery powerful in proportion.

The following table shows the progressive improvement made in the speed of the boats from New Orleans to Louisville (distance fourteen hundred and eighty miles), 1815 to 1853:

Date.	Name of Steamer.	Days.	Hours.	Minutes.	Date.	Name of Steamer.	Days.	Hours.	Minutes.
May, 1815	Enterprise.....	25	2	40	April, 1840	Edward Shippen..	5	14	00
April, 1817	Washington.....	25	00	00	April, 1842	Belle of the West.	6	14	00
Sept., 1817	Shelby.....	20	4	20	April, 1843	Duke of Orleans...	5	23	00
May, 1819	Paragon.....	18	10	00	April, 1844	Sultana.....	5	12	00
Nov., 1828	Tecumseh.....	8	4	00	May, 1849	Bostona.....	5	8	00
April, 1834	Tuscarora.....	7	16	00	June, 1851	Belle Key.....	4	23	00
Nov., 1837	General Brown.	6	22	00	May, 1852	Reindeer.....	4	20	45
Nov., 1837	Randolph.....	6	22	00	May, 1852	Eclipse.....	4	18	00
Nov., 1837	Empress.....	6	17	00	May, 1853	A. L. Shotwell.....	4	10	20
Dec., 1837	Sultana.....	6	15	00	May, 1853	Eclipse.....	4	9	30

The last was the quickest time on record up to that date. Her average speed was fourteen miles an hour against the stream.

The following table is a full and complete list of steamers in the transatlantic trade wrecked and lost since the steamship "Sirius" first crossed the Atlantic Ocean, in the year 1838, to 1879 inclusive, a period of forty years. It is reprinted by special permission of the American Ship Publishing Company, by whom it was copyrighted, April 19, 1879, when it was published as a supplement to "The American Ship.' All vessels not marked as side-wheel are screw steamers; those marked thus * are wooden vessels; all the rest were built of iron. The compilation of such a schedule is a work of no small magnitude, involving, as it did, a careful reference to almost forgotten and dust-covered records of disaster, and a careful comparison of the data thus obtained with the imperfect lists prepared from other sources, which have, from time to time, appeared in the public prints. This list was compiled from records in the archives of the ATLANTIC MUTUAL INSURANCE COMPANY, of New York City, by one of its employés. The details of the construction of each vessel have been given in every instance in which it was possible to obtain them. The ratings are those of the Board of Inspectors of that standard company.

TRANSATLANTIC STEAM-VESSELS WRECKED AND LOST FROM 1838 TO MARCH, 1879, GIVING

Flag.	Name.	Rig.	Where and When Built.	Tonnage.	Bulkheads.	Draft.	Rate.	Line.	From.
Br....	*President[1]	.....	1839 or 1840	2366	.....	.....	.....	.....	New York
Br....	*Columbia	.....	.....	.....	.....	.....	.....	Cunard	Boston
Br....	*Mountaineer	.....	.....	.....	.....	.....	.....	.....	Liverpool
Am...	*Humboldt[1]	.....	New York, 1850	2500	.....	19	A 1	Havre	Havre
Br....	*City of Glasgow	.....	Glasgow, 1850	1609	5	16	A 1¼	Inman	Liverpool
Am...	*Franklin[1]	.....	New York, 1848	2300	.....	19	A 1½	.....	Southampton
Am...	*City of Philadelphia	.....	.....	.....	.....	.....	.....	.....	Liverpool
Am...	*Arctic[1]	.....	New York, 1850	3000	.....	19	A 1	Collins	Liverpool
Br....	*Her Majesty	.....	.....	.....	.....	.....	.....	.....	England
Am...	*North Carolina[1]	3 Msts	Philadelphia, 1854	700	.....	12	A 2	.....	Philadelphia
Am...	*Pacific[1]	.....	New York, 1849	.....	.....	.....	A 1	Collins	Liverpool
Fr....	Le Lyonnais	Bk.....	Liverpool, 1856	1065	5	19	A 1½	Franco-American	New York
Br....	Tempest	Ship...	Glasgow, 1855	798	4	17½	A 1¼	.....	New York
Br....	Canadian (1)	Bk.....	Dumbarton, 1854	1764	5	20	A 1½	Montreal	Liverpool
Ger...	Austria	Bk.....	Greenock, 1857	2400	6	19½	A 1¼	Kunhardt	Hamburg
Br....	Argo	.....	London, 1853	2315	.....	19	A 1	.....	New York
Br....	Indian	.....	Dumbarton, 1855	1764	5	18	A 1¼	Canadian	Liverpool
Br....	Hungarian	.....	.....	.....	.....	.....	.....	.....	Liverpool
Br....	Connaught	.....	Newcastle, 1859	4400	.....	.....	.....	.....	Galway
Br....	Canadian (2)	.....	.....	.....	.....	.....	.....	.....	Quebec
Br....	North Briton	.....	Dumbarton, 1857	2300	.....	22	A 1¼	Montreal Ocean S. N. Co	Quebec
Br....	Spartan	.....	.....	.....	.....	.....	.....	.....	England
Br....	Rechid	.....	.....	.....	.....	.....	.....	.....	London
Br....	Caledonia	.....	Glasgow, 1862	1266	.....	18	A 1½	.....	Glasgow
Br....	Anglo-Saxon	Bk.....	Dumbarton, 1856	1673	5	21	A 1½	Montreal	Liverpool
Br....	Norwegian	.....	.....	.....	.....	.....	.....	Montreal	Liverpool
Br....	Georgia	.....	Newcastle, 1863	2635	5	21	A 1	Williams & Guion	New York
Br....	Pactolus	.....	.....	.....	.....	.....	.....	.....	Liverpool
Br....	Bohemian	.....	.....	.....	.....	.....	.....	Montreal S. N. Co	Liverpool
Br....	City of New York	Bk.....	Glasgow, 1861	2509	5	22	A 1¼	Inman	New York
Br....	Jura	Bk.....	Glasgow, 1854	2334	5	20	A 1¼	.....	Quebec
Br....	Iowa	Bk.....	Waterford, 1864	1988	6	21	A 1¼	Anchor	London
Br....	George Olympus	Trn ...	England, 1860	423	5	9	A 2½	.....	New York
Br....	Glasgow	.....	Glasgow, 1851	1962	.....	19	A 1½	Inman	New York
Br....	Circassian	.....	Belfast, Ireland, 1857	1387	4	20	A 2	.....	Bremen
Br....	Ephesus	4 Msts Sch....	Newcastle, 1864	1438	4	19	A 1½	.....	Norfolk
Br....	Scotland	Bk.....	Newcastle, 1865	3803	6	22	A 1	Williams & Guion	New York
Br....	Amsterdam	Bgt ...	Newcastle, 1866	639	5	14	A 1¼	.....	Malaga
Br....	Chicago	Bg.....	Jarrow, 1866	1948	5	22	A 1	Williams & Guion	New York
Br....	Melita	Bk.....	Dumbarton, 1853	1254	4	18	A 1¾	.....	Boston
Br....	Hibernia	Bk.....	Glasgow, 1865	1569	5	17	A 1½	Anchor	New York
Br....	Pantheon	Bk.....	Preston, Eng., 1867	998	4	15	A 1½	.....	New Orleans
Br....	United Kingdom	Bk.....	Greenock, 1857	1255	4	18	A 1½	Anchor	New York
Ger...	Germania	Bk.....	Greenock, 1863	2552	7	22	A 1	Kunhardt	New York
Br....	Cleopatra	T. Sch	Sunderland, 1865	982	5	15	A 1¼	.....	Montreal
Br....	Grecian	Bk.....	Belfast, 1861	1854	5	21	A 1½	Anchor	Palermo
Br....	City of Boston	Ship...	Greenock, 1864	2254	5	20	A 1	Inman	New York
Br....	Cambria	Bktn..	Port Glasgow, 1869	2140	6	19	A 1¼	Anchor	New York
Ger...	Union	Bg.....	Greenock, 1868	2873	7	19	A 1	N. G. Lloyds	Bremen
Br....	Crescent City	Bg.....	Dumbarton, 1870	2105	4	21	A 1	L. & Mis. S. S. Co.	New Orleans
Br....	Zoe	T. Sch	Sunderland, 1868	803	4	15	A 1½	.....	New York
Fr....	Lafayette	Bg.....	Greenock, 1864	3204	6	18	A 1½	Com. Genl. Trans.	New York
Br....	Mima Thomas	Bgt ...	Stockton, 1870	988	5	17	A 1¾	.....	New York
Br....	Colorado	Bg.....	Jarrow, 1867	2888	5	23	A 1	Williams & Guion	Liverpool
Br....	Dacian	Bkt ...	Glasgow, 1868	1100	6	18	A 1½	Anchor	London
Br....	Concordia	Bg	Glasgow, 1862	1681	.....	17	A 1¾	.....	New Orleans
Br....	Tripoli	Bg.....	Glasgow, 1865	1953	7	20	A 1	Cunard (?)	Liverpool
Ger...	Baltimore	Bg.....	Greenock, 1868	2064	5	20	A 1¼	N. G. Lloyds	Baltimore
Br....	Adalia	.....	Sunderland, 1864	1270	4	17	A 1½	.....	London
Br....	Caspian	Sc.....	Low Walker, 1871	1323	4	17	A 1½	.....	Montreal
Br....	Edith Emily	Sc.....	Middlesboro', 1871	1120	4	17	A 1½	.....	Liverpool
Br....	George Carins	Trn ...	Newcastle, 1871	1146	3	16	A 1½	.....	Montreal

* Wooden vessels. [1] Side-wheels.

THE PARTICULARS RELATING TO EACH DISASTER, AND THE LOSS OF LIFE WHERE KNOWN.

To.	Date of Loss.	Location of Loss.	Nature of Loss.	Loss of Life.	Remarks.
Liverpool	Sailed Mch., 1841		Missing	All lost	
Halifax	July 2, 1843	Black Ledge	Wrecked	1 man lost	
St. John's, N. B.	Dec. 25, 1852	Near Currituck, N. C.	Wrecked	All saved	
New York	Dec. 6, 1853	Near Halifax	Wrecked	All saved	
Philadelphia	Sailed Mch., 1854		Missing	450 lost	
New York	July, 1854	Off Montauk Point	Wrecked	All saved	
Philadelphia	Sept. 14, 1854	Cape Race	Wrecked	All saved	
New York	Sept. 27, 1854	40 miles off Cape Race	Sunk	562 lost	Sunk by collision with "Vesta" (S.S.).
Quebec	Sailed Aug., 1854		Missing	All lost	Intended for service on the lakes. No passengers or cargo.
Liverpool	April, 1855	Off Holyhead	Sunk by col	All saved	
New York	Sailed Jan. 23, 1856		Missing	200 lost	
Havre	Nov. 2, 1856	Off Nantucket	Sunk	260 lost	Sunk by collision with bark "Adriatic."
Glasgow	Sailed Feb. 11, 1857		Missing	All lost	
Quebec	June 1, 1857	Near Quebec	Wrecked	All saved	
New York	Sept. 13, 1858	Lat. 45° 1′. Lon. 41° 30′	Burned	538 lost	
Galway	June 23, 1859	Trepassy Bay, N. F.	Wrecked	All saved	
Portland	Nov. 21, 1859	Guysboro', N. S.	Wrecked	3 lost	
Portland	Feb. 19, 1860	Cape Sable, N. S.	Wrecked	205 lost	
Boston	Oct. 6, 1860	Near Boston	Burned	All saved	Said to have been a cheap, poorly-built ship.
Liverpool	June 4, 1861	Straits Belle Isle	Sunk by ice	30 lost	
Liverpool	Nov. 5, 1861	Mingan Island	Wrecked	All saved	
Halifax	Feb. 16, 1862	Lat. 43° 9′ N. Lon. 38° 2′ W.	Abandoned	All saved	
Baltimore	Sailed Dec., 1861		Missing	All lost	
New York	Dec. 31, 1862	Cape Cod, Mass.	Wrecked	All saved	Saved, repaired, and name changed to "Concordia."
Quebec	April 27, 1863	Cape Race	Wrecked	237 lost	
Quebec	June 14, 1863	St. Paul's Island, C. B.	Wrecked	All saved	
Liverpool	Aug. 4, 1863	Sable Island, N. S.	Wrecked	All saved	
St. John's, N. B.	Sept. 8, 1863	Little Hope Bar, N. F.	Wrecked	All saved	
Portland	Feb. 22, 1864	Alden's Rock, Cape Elizabeth, Me.	Wrecked	20 lost	
Liverpool	March 29, 1864	Daunt's Rock, Queenstown	Wrecked	All saved	
Liverpool	Nov. 3, 1864	Mouth of the Mersey	Wrecked	All saved	Formerly a "Cunarder."
New York	Dec. 6, 1864	Near Cherbourg	Wrecked	All saved	Raised, repaired, and name changed to "Macedonia."
London	May 24, 1865	Off Sandy Hook	Foundered	All saved	Was consid'd a poor sea risk.
Liverpool	July 31, 1865	At sea	Burned	All saved	By Am. bark "Rosamond."
New York	Oct. 20, 1865	Arichat, C. B.	Wrecked	All saved	Off, and taken into Arichat, Nov. 9, 1865.
Liverpool	July 6, 1866	Cape Sable	Wrecked	All saved	
Liverpool	Dec. 1, 1866	Middle Bar, Sandy Hook	Wrecked	All saved	Col. with ship "Kate Dyer."
New York	Oct. 20, 1867	Near Montauk Point	Wrecked	All saved	
Liverpool	Jan. 12, 1868	Roche's P'nt, near Queenstown	Wrecked	All saved	
Liverpool	Sept. 5, 1868	Lat. 49°. Lon. 28° 40′	Burned	All saved	
Glasgow	Nov. 25, 1868	Coast of Ireland	Foundered	50 lost	
Liverpool	March 6, 1869	S. W. Pass, N. O.	Sunk	All saved	Collided with "Heroine."
Glasgow	Sailed April 17, 1869		Missing	All lost	
Hamburg	Aug. 7, 1869	Trepassy, N. F.	Wrecked	All saved	
London	Aug. 8, 1869	Trepassy, N. F.	Wrecked	All saved	
New York	Dec. 15, 1869	Jones' Inlet, L. I.	Wrecked	All saved	
Liverpool	Sailed Jan. 25, 1870		Missing	All lost	
Glasgow	Oct. 19, 1870	Coast of Ireland	Wrecked	196 lost	
New York	Nov. 29, 1870	Rattray Head, Scotland	Wrecked	All saved	
Liverpool	Feb. 8, 1871	Galley Head, Ireland	Wrecked	All saved	
Brest	Feb. 20, 1871	Bell Rock, near Sambro, N. S.	Wrecked	All saved	Was ashore Dec., 1869, in the same neighborhood.
Havre	Sept. 23, 1871	Havre	Burned	All saved	
Liverpool	Dec. 3, 1871	Lat. 50° 18′. Lon. 29° 3′	Abandoned	All saved	Rescued by Cunard steamship "Aleppo."
New York	Feb. 7, 1872	Mouth of the Mersey	Collided and wrecked	5 lost	Was in collis'n with steamer "Arabian," and sunk when in tow.
New York	April 9, 1872	Jeddore, near Halifax	Wrecked	All saved	
Liverpool	May 1, 1872	Cape Breton	Wrecked	All saved	Ex "Caledonia." Light upper deck added.
Boston	May 17, 1872	Coast of Ireland	Wrecked	All saved	
Bremen	May 22, 1872	Hastings	Ashore after collision	All saved	Gotten off and repaired.
Quebec	June 25, 1872	St. Paul's Island	Wrecked	All saved	
Waterford	Aug. 9, 1872	Belle Island	Wrecked	All saved	
Montreal	Sept. 2, 1872	Point de Montes	Wrecked	All saved	Condem'd and sold Oct., 1872.
Limerick	Oct. 4, 1872	Off Sydney, C. B.	Capsized	8 lost	

TRANSATLANTIC STEAM-VESSELS WRECKED AND LOST FROM 1838 TO MARCH, 1879,

Flag.	Name.	Rig.	Where and When Built.	Tonnage.	Bulkheads	Draft.	Rate.	Line.	From.
Br....	*Carolina	T. Sch	Stockton, 1860	1174	3	16	A 1½		Baltimore
Br....	*Scanderia	Bkt....	Glasgow, 1866	1983	4	21	A 1¼	E. E. Morgan	New York
Br....	*Tacora	Bk.....	Glasgow, 1872	3525	6	22	A 1		Liverpool
Br....	Commander	Sc.....	Sunderland, 1871	1160	4	19	A 1½		Montreal
Br....	Mary Church		No record						Montreal
Br....	Czarina		No record						Montreal
Br....	Shannon	Bg.....	Dundee, 1871.	1210	6	17	A 1½		Montreal
Br....	Germany	Bk.....	Stockton, 1868	3244	7	22	A 1	Allan	Liverpool
Span.	Churruca	Sch....	Seacombe, 1870	905	5	15	A 1½		New York
Br....	Sir Francis	Bg.....	Glasgow, 1872	1833	3	19	A 1	Warren & Co.	Liverpool
Br....	Devon	Sc.....	Port Glasgow, 1872	1411	5	20	A 1		Montreal
Nor..	Woodham		W. Hartlepool, 1869	1037	4	19	A 1¾		Newcastle
Br....	Talisman	T. Sch	Greenock, 1860	580	5	16	A 2		Brazil
Br....	Atlantic	4 Mets Bkt...	Belfast, 1871	3707	7	21½	A 1	White Star	Liverpool
Ger...	Thorwaldsen	Bg.....	Sunderland, 1872	2206	5	20	A 2½	Baltic Lloyds	New York
Br....	City of Washington	Ship...	Glasgow, 1855	2408	5	21	A 1½	Inman	Liverpool
Br....	Panther		No record						Montreal
Br....	Medway	Bg.....	Sunderland, 1865	1834	5	20	A 1¼		Quebec
Br....	Missouri	Bk.....	Greenock, 1855	1989	7	18½	A 1¾	Miss. & Dominion	Liverpool
Br....	Ismalia	Bkt....	Glasgow, 1870	1629	7	19½	A 1½	Anchor	New York
Fr....	Ville du Havre	Bk.....	Blackwall, 1865.. Rebuilt, 1872	5086	6	22	A 1	Comp. Genl. Trans.	New York
Ger...	König Wilhelm I	Bg.....	Greenock, 1870	3300	6	20	A 1	N. G. Lloyds	New York
Br....	Flamsteed	Bg.....	Newcastle, 1866	1376	6	19	A 1½	Brazil Line	Liverpool
Br....	Ravensworth Castle	Bkt....	Sunderland, 1871	1967	6	19½	A 1½		Baltimore
Fr....	Alexandre Lavallay	Bk.....	Nantes, 1869	839	3	17	A 1½		London
Fr....	Europe	Bg.....	Glasgow, 1864	5333	6	19	A 1¼	Comp. Genl. Trans.	Havre
Br....	Mississippi		Dumbarton, 1871	2159	4	20	A 1		Liverpool
Nor..	Anna	Bkt....	Middlesboro, 1873	1391	5	20	A 1½		New York
Br....	Linda	Sch	Liverpool, 1873	1046	4	18	A 1¼		Barrow, Eng.
Br....	Trojan	Bk.....	Port Glasgow, 1867	744	4	16	A 1½	Anchor	London
Br....	Viking	Sch	Dundee, 1869	885	5	15	A 1½		Liverpool
Br....	Corinth	T. Sch	Sunderland, 1872	959	4	15	A 1½		New York
Br....	Mary	Sc.....	Glasgow, 1874	411		10	A 1½		Glasgow
Br....	Delta	Bg.....	Hull, 1872	1974	6	18	A 1½		London
Fr....	Morena		La Seyne, 1873	1971	4	17½	A 1¾		Rio Janiero
Br....	Life Brigade	T. Sch	Sunderland, 1873	978	4	18	A 1¾		Liverpool
Ger...	Schiller	Bg.....	Glasgow, 1873	3408	7	21	A 1	Eagle	New York
Br....	Vicksburg	Bg.....	Dumbarton, 1872	2484	4	21	A 1	Miss.& Dom.S.S.Co.	Montreal
Br....	Strathtay (1)	T. Sch	Dundee, 1871	1081	5	15	A 1½		Montreal
Br....	Abbotsford	Bg.....	Dundee, 1873	2540	6	20	A 1		Philadelphia
Br....	Shannon	Bg.....	Glasgow, 1869	3609		22	A 1½	R. M. S. S. Co.	Aspinwall
Span.	Ville de Bilbao		Port Glasgow, 1874	1758	4	21	A 1½		Liverpool
Span.	Algeria		Sunderland, 1873	1757	5	20	A 1½		Barcelona
Ger...	Deutschland	Bg.....	Greenock, 1866	2873	4	22	A 1	N. G. Lloyds	Bremen
Fr....	Louisiane		Glasgow, 1862	1780	4	21	A 1¾	Comp. Genl. Trans.	West Indies
Br....	Bothnia	T. Sch	Newcastle, 1871	1323	4	17	A 1½		New Orleans
Br....	Great Western	Bgt...	Sunderland, 1872	1543	5	18½	A 1½		Messina
Belg.	C. F. Funch	Bk.....	Kirkcaldy, 1871	1556	5	19	A 1½		New York
Br....	Arbitrator	Sc.....	Sunderland, 1872	1262	4	16	A 1½		New Orleans
Ger...	Sylvia	Sc.....	Kiel, Germany, 1872	1090	5	19	A 1½		Philadelphia
Br....	Colombo	Bk.....	Hull, England, 1872	2624	3	21½	A 1¼	Wilson Line	Hull
Fr....	Amerique	Bk.....	St. Nazaire, 1864 Reb't, Eng., 1873	4584	10	23	A 1½	Comp. Genl. Trans.	Havre
Br....	Bavaria	Bk.....	Greenock, 1856	2273	7	20	A 2	Miss.& Dom.S.S.Co.	New Orleans
Br....	Rusland	Bg.....	Dundee, 1872	2595	5	21	A 1¼		Antwerp
Br....	Dakota	Bg.....	Jarrow, Eng., 1874	4332	7	25	A 1	Williams & Guion	Liverpool
Span.	Diego	Bk.....	Liverpool, 1865	2779	4	19	A 1½		New York
Br....	Mexican	Bg.....	Hartlepool, 1863	1315	5	16	A 1¾	W. I. & Pacific Co.	Port Royal
Br....	Durley	Bkt....	Jarrow, Eng., 1871	1148	4	14	A 2		New York
Br....	Strathesay	Sc.....	Dundee, 1877	1350	5	18	A 1½		Montreal
Br....	Rowland	Sc.....	Sunderland, 1875	1231	4	19	A 1½		Montreal
Br....	Stamfordham	Bgt...	Hebburn, 1877	1483	4	17	A 1½		Baltimore
Br....	Arratoon Apcar	Trn....	Renfrew, 1861	1493	4	20	A 1¾		Liverpool
Br....	Chelydra	Sc.....	Middlesboro', 1873	1487	5	20	A 1½		Newcastle
Ger...	Karnak		Hartlepool, 1872	1268	4	19	A 1¼		Montevideo, etc.
Br....	Chicago	Sc.....	W. Hartlepool, 1878	1384	4	16	A 1¾		W. Hartlepool
Br....	Sardinian	Bk.....	Greenock, 1874	4376	9	23	A 1	Allan	Liverpool
Br....	Idaho	Bg.....	Jarrow, Eng., 1869	2024	5	21	A 1¼	Williams & Guion	New York
Br....	Yoxford	Bgt ...	Low Walker, 1878	1989	5	21	A 1½		New York

* Wooden vessels.

GIVING THE PARTICULARS RELATING TO EACH DISASTER, ETC.—*Continued.*

To.	Date of Loss.	Location of Loss.	Nature of Loss.	Loss of Life.	Remarks.
Queenstown	Nov. 14, 1872	Lat. 44°. Lon. 53° 20'.	Abandoned	All saved	
Queenstown	Sailed Oct. 8, 1872		Missing	All (45) lost.	
Montevideo	Dec. 1872	Near Montevideo	Wrecked		
Falmouth	Sailed Nov. 2, 1872		Missing	All lost	Loaded with grain, alleged badly.
Liverpool	Sailed Nov., 1872		Missing	All lost	Reported badly loaded.
Liverpool	Nov. 1872	At sea	Foundered		Reported badly loaded.
London	Sailed Nov. 4, 1872		Missing	All lost	
New Orleans	Dec. 23, 1872	Mouth of the Gironde	Wrecked	30 lost	
Waterford	Sailed Nov. 2, 1872		Missing	All lost	Lightly built.
Boston	Jan. 3, 1873	Salisbury Beach, N. H.	Wrecked	All saved	
United Kingdom	Sailed Nov. 2, 1872		Missing	All lost	
New York	Feb. 2, 1873	Isle of Wight	Wrecked	All saved	Gotten off June, 1873.
Hamburg	Jan. 21, 1873	Off Lisbon	Foundered	12 lost	
New York	April 1, 1873	Meagher's Head, N. S.	Wrecked	546 lost	22 miles west of Halifax.
Stettin	April 4, 1873	Coast of Sweden	Wrecked	All saved	
New York	July 5, 1873	70 miles from Sambro, N. S.	Wrecked	All saved	Lengthened 39 feet, 1869.
England	Sept. 1873	Strait of Belle Isle	Wrecked	4 lost	
London	Sept. 6, 1873	Strait of Belle Isle	Wrecked	Several lost.	
New Orleans	Oct. 1, 1873	Bahamas	Wrecked	All saved	
Glasgow	Sailed Sept. 29, 1873		Missing	All lost	
Havre	Nov. 23, 1873	Lat. 47°21' N. Lon. 35°31' W.	Sunk	230 lost	By collis'n with ship "Loch Earn," ex "Napoleon III."
Bremen	Ab't Nov. 27, 1873	Nieuw Dieppe, Holland	Wrecked	All saved	This vessel may have been ultimately saved.
Rio Janeiro	Nov. 24, 1873	Lat. 25°35' N. Lon. 50°51' W.	Sunk	All saved	By collision with ironclad "Bellerophon"; sunk by ram.
Leith	Jan. 8, 1874	Scrabster, England	Wrecked	All saved	
New York	Jan. 23, 1874	Southampton, L. I.	Wrecked	All saved	
New York	April 4, 1874		Abandoned	All saved	Lengthened 30 feet in 1873.
New Orleans	April 20, 1874	Cape Florida	Wrecked	All saved	Afterwards gotten off.
Rotterdam	Sailed Feb. 15, 1874		Missing	All lost	
Quebec	May 1, 1874	Lon. 43° W.	Burned	All saved	Rescued by S.S. "Circassian."
New York	Sailed April 9, 1874		Missing	All lost	
Montreal	May 11, 1874	Point Au Strete, St. Lawr'ce	Wrecked	All saved	
Liverpool	Aug. 2, 1874	Galley Head	Wrecked	All saved	
Trinidad	Oct. 21, 1874	At sea	Foundered	10 lost	
Quebec	Nov. 4, 1874	Cape Chatte, Anticosti	Wrecked	All saved	
Havre	Oct. 15, 1874	Maricos Bar	Wrecked	?	
New Orleans	Feb. 8, 1875	Near Nassau	Wrecked	All saved	
Hamburg	May 7, 1875	Scilly Islands	Wrecked	200 lost	
Liverpool	June 1, 1875	120 miles from St. Jns., N.B.	Sunk by ice	40 lost	Was rep. lost in Aug. 1872.
London	June 21, 1875	Bic Island Reef	Wrecked	?	
Liverpool	July 21, 1875	Coast of Wales	Wrecked	All saved	
Southampton	Sept. 1875	Pedro Bank, Jam.	Wrecked	?	Lengthened, 1875.
Havana	Sept. 30, 1875	Near Brest	Wrecked	2 lost	
West Indies	Nov. 25, 1875	Cabrits Island	Wrecked	?	
New York	Dec. 5, 1875	Kentish Knock, North Sea.	Wrecked	157 lost	
France	Dec. 20, 1875	Sunk by collision	In the Gironde	16 lost	
Liverpool	Feb. 15, 1876	At sea	Burned	All saved	
New York	March 25, 1876	Amityville, L. I.	Wrecked	All saved	
Antwerp	Aug. 24, 1876	River Sheide	Burned	All saved	
Liverpool	Aug. 23, 1876	At Sea	Sunk by ice	All saved	
Havre	Sept. 22, 1876	At Sea	Abandoned	All saved	
New York	Sailed Dec. 3, 1876		Missing	All lost	
New York	Jan. 7, 1877	Seabright, N. J.	Ashore	3 lost	Gotten off April 10, 1877. Was aband. April 14, 1874, bet. Brest and Havre, and after'ds towed to Falmouth.
Liverpool	Feb. 6, 1877	Lat. 31° 14'. Lon. 78° 42'.	Burned	All saved	Saved by Br. bk. "Dorothea."
New York	March 17, 1877	Long Branch, N. J.	Wrecked	All saved	
New York	May 9, 1877	Anglesea, Wales	Wrecked	All saved	
Liverpool	Sept. 8, 1877	Lat. 46°. Lon. 37.	Burned	All saved	Rescued by bk. "Arklow."
Liverpool	Sailed Sept. 15, 1877		Missing	All lost	
Brest	Sailed Oct. 5, 1877.		Missing	All lost	Was rep. "loaded too deeply."
Aberdeen	Nov. 17, 1877	St. Pierre Miquelon	Wrecked	All saved	
England	Sept. 19, 1877	Holyrood Beach, N. F.	Wrecked	All saved	
Ipswich	Sailed Dec. 29, 1877		Missing	All lost	
Havana	Feb. 17, 1878	Fowey Rocks, Bahama B'ks	Wrecked	All saved	
New Orleans	Dec. 19, 1877	Silver Bank, off Port Au Plata	Abandoned	All saved	
Antwerp	Jan. 23, 1878	Punta de Medanos	Wrecked	All saved	Mouth of Rio de la Platte.
Boston	May 8, 1878	Longsand, near Hardwick.	Wrecked	All saved	
Quebec	May 10, 1878	Off Londonderry	Burned	Many lost	This fire occurred from an explos'n. She was scuttled and raised again.
Liverpool	June 1, 1878	N'r Coninbeg Lightship, coast of Ireland	Wrecked	All saved	
Havre	Sept. 12, 1878	English coast	Abandoned	All saved	Rescued by bg. "Wesley and Seymour."

TRANSATLANTIC STEAM-VESSELS WRECKED AND LOST FROM 1838 TO MARCH, 1879,

Flag.	Name.	Rig.	Where and When Built.	Tonnage.	Bulkheads.	Draft.	Rate.	Line.	From.
Br....	Copia.....	Sc.....	Newcastle, 1876.....	1529	5	19	A 1¾	.....	Barrow, Eng.....
Br....	John Bramall.....	Bkt...	Stockton, 1873.....	1463	4	19½	A 1¾	.....	New Haven.....
Br....	Ely Rise.....	Sch ...	Sunderland, 1877.....	1212	5	15	A 1¾	.....	Cardiff.....
Ger...	Pommerania.....	Bg.....	Greenock, 1873.....	3382	.....	23	A 1	Ham. Am. Pack. Co.	New York.....
Belg.	Hermann Ludwig.....	Bkt...	Kinghorn, Scot., 1870	1505	5	20	A 1	Antwerp.....	New York.....
Br....	State of Louisiana.....	Bkt...	Glasgow, 1872.....	1869	4	20	A 1	State Line.....	Glasgow.....
Br....	Lartington.....	Trn...	Sunderland, 1875.....	1357	5	15	A 1¾	.....	Savannah.....
Br....	Kate	Sc.....	Whitby, 1874.....	1416	4	20	A 1½	.....	Galveston.....
Br....	Bayard.....	Trn...	Stockton, 1878.....	1493	.....	20	A 1½	.....	New Orleans.....
Br....	Homer	Sc.....	Low Walker, 1877.....	1916	5	20	A 1½	.....	Boston .....
Br....	Wycliffe.....	T. Sc..	Newcastle, 1874.....	1252	4	20	A 1¾	.....	Philadelphia.....
Br....	Zanzibar.....	T. Sch	W. Hartlepool, 1877..	2245	4	21	A 1½	.....	New York.....
Br....	Aberfeldy.....	Sch...	Hartlepool, 1875.....	1352	4	19	A 1½	....	Philadelphia.....
Span.	Guillermo.....	Bkt...	Liverpool, 1872.....	1733	4	20	A 1½	....	Baltimore.....

NOTES.

NOTE TO PAGE 9, ON JONATHAN HULLS.—The following doggerel is the burden of a common street-ditty among the boys of Campden in Gloucestershire:

"Jonathan Hulls,
With his patent skulls,
Invented a machine
To go against wind and stream;
But he, being an ass,
Couldn't bring it to pass,
And so was ashamed to be seen."

Notes and Queries, vol. iii., 1st series.

NOTE TO PAGE 16, ON JOHN FITCH.—The remains of John Fitch were interred in the village graveyard of Bardstown, Nelson County, Kentucky, in the rear of the court-house and county jail, in 1798. Not a pebble of all the fine stone in the land marks his last resting-place. But his last will and testament is on record, as copied by a correspondent (T. H. T.) to the Philadelphia *Evening Telegraph*, under date August 31, 1874, viz.:

"I John Fitch of the County of Nelson do make this my last will and testament. To William Rowan Esqr, my trusty friend my beaver hat shoe knee and stock buckles walking stick, and spectacles To Doctor William Thornton of the City of Washington in District of Columbia .To Eliza Vail, daughter of Aaron Vail Consul of the United States at L'Orient To John Rowan Esq. of Beards Town son of said William and to James Nourse of said town I bequeath all the rest of my estate real and personal to be divided amongst them share and share alike and I appoint the said John Rowan Esq. and James Nourse Esq: my executors and the legacies hereby bequeathed to them my said Executors is in consideration of their accepting the Executorship and bringing to a final close all suits at law and attending to the business of the estate hereby bequeathed Hereby declaring this to

GIVING THE PARTICULARS RELATING TO EACH DISASTER, ETC.—*Continued.*

To.	Date of Loss.	Location of Loss.	Nature of Loss.	Loss of Life.	Remarks.
Montreal	Sailed Sept. 11, 1878		Missing	All lost	
Constantinople	Oct. 18, 1878	Little Gull Island, L. I. S.	Wrecked	All saved	
Tybee	Oct. 23, 1878	Scilly Islands	Ashore, towed off, sunk	All saved	She was subsequently raised.
Hamburg	Nov. 25, 1878	Off Folkestone	Sunk by col	Over 50 lost.	
Antwerp	Sailed Sept. 28, 1878		Missing	All lost	
New York	Dec. 24, 1878	Lough Larne, Ireland	Wrecked	All saved	
Reval	Dec. 14, 1878	Bermuda	Wrecked	All saved	
Havre	Dec. 1, 1878	Bermuda	Wrecked	All saved	
Rouen	Dec. 10, 1878	At sea	Foundered	Only 2 saved	
Liverpool	Sailed Dec. 17, 1878		Missing	All lost	
St. Nazaire	Feb. 17, 1879	Entrance to Loire River	Wrecked	All saved	
Glasgow	Sailed Jan. 11, 1879		Missing	All lost	
Ipswich	Feb. 1879	Gulf Stream	Abandoned	All saved	This vessel had put back to Phila., Feb. 7, leaking from dam. by ice, & sailed again.
Liverpool	March 1, 1879	Coast of Ireland	Sunk by col	All saved	

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be my last will and testament this the 20th day of June One Thousand Seven Hundred and ninety-eight—Witness my hand and seal,

"JOHN FITCH.

"Acknowledged, signed and sealed in presence of

"JAMES NOURSE
"MICHAEL RENCH
Her
"SUSANNAH ⋈ McCOWN
mark

"On the 10th of July following the will was proved by the executors, and ordered to be recorded."

NOTE TO PAGE 26.—"An experiment was tried in the river (Thames?) on a coal-barge to work against the tide by means of an apparatus fixed to the sides; so contrived that when put in motion (which was done by a fire-engine) it rowed three pair of oars, and required only the assistance of one man to steer. It seems rather too complex a business in its present state, but the plan appearing practicable, and should it succeed by some judicious constructing, it must prove of immense advantage to the (coal?) trade."—*British Magazine and Review* of 1783, under date October 26, 1783.

In 1797 an experiment in canal steam navigation was made in the neighborhood of Liverpool, and the *Monthly Magazine* for July of the year says, "Lately at Newton-Common, in Lancashire, a vessel heavily laded with copper flag passed along the Sankey Canal without the aid of haulers or rowers, the oars performing eighteen strokes a minute by the application of *steam* only! After a course of ten miles the vessel returned the same evening by the same means to St. Helen's, whence she had set out. This ingenious discovery by the original form and motion of the oars may be ranked amongst the most useful of modern inventions, and in particular promises the highest benefits to inland navigation."

ERRATUM.—On page 104 it is stated that "In the autumn of 1839, Ericsson came to the United States, and died at Richland, New York, March 5, 1869." Captain Ericsson is still living, November, 1881, in New York.